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## PIG INDUSTRY.

### THE PRINCIPAL BREEDS.

M. J SCOTT, Superintendent of the Pig Industry.

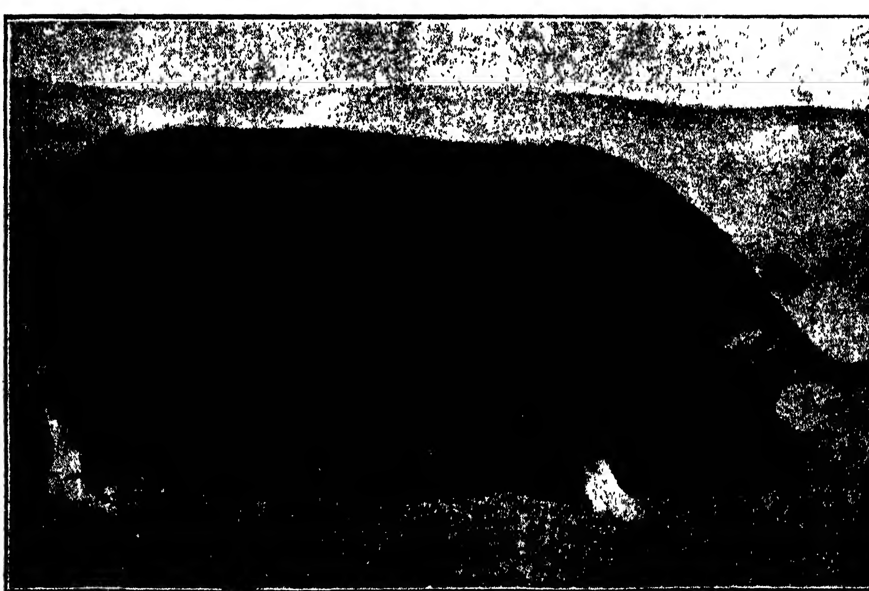
ADVOCATES of the different breeds of pigs found in New Zealand may be disappointed because the virtues of their particular breed are not sufficiently stressed in these notes. It is now generally recognized that every breed possesses certain strains that can produce the kind of animal that is required, and the sooner it is admitted by everyone that pigs suitable for the English trade are to be found in every breed, and the sooner one breed, or, at most two, are selected for the production of commercial pigs, the sooner will New Zealand pigs be keenly sought after on the English market. The improved demand for New Zealand pigs will arise from an improvement in quality associated with an improvement in uniformity, and uniformity is most important. When there are many equally good, but slightly different, articles offered to a buying population, business tends to be sluggish; each buyer is watching the others to be sure that no small point is missed, and all are hanging back till a certain fashion is established. Offer a buying public an article that is the same to-day, to-morrow, in all shops and markets, and it tends to buy freely of the best that is offering. Only the best is good enough, and the moral for the producer seems to be " have only one best and no worst."

### THE BERKSHIRE.

The Berkshire is the best-known breed in New Zealand, and the majority of grade sows have a dash of this blood in them. They are looked upon as a hardy pig and a good doer. While this was a virtue in days gone by, and was shown by the way in which the pig piled on fat on the crest of his neck just between his ears and the top of his shoulder-blades, that same class of pig is not so desirable to-day except for the pork trade, or for the pig-jobber who does not care what kind of pigs he produces so long as they do well and get off the place. This type of Berkshire has been replaced in the stud world, almost entirely, by a longer, leaner animal that produces almost as good a carcass as the best of baconer breeds do. Berkshires make excellent porkers, but the fact that they are black discounts them somewhat on the English pork market. Baconers are not objected to because they are black as the operation of singeing removes the colour objection. The importation

*Berkshire Types.*

BOAR (ROYAL CHAMPION, 1932).



SOW (ROYAL CHAMPION, 1932).

[*N.Z. Farmer Weekly photos.*

some ten years ago from Canada of strains of Berkshires whose length, fine shoulders, and splendid hams made them highly suitable for the bacon trade did much to bring the Berkshire breed back into the public mind. If only the Canadian strains were more fixed for colour and "points-appearance," they would be entirely acceptable.

The Berkshire is one of the oldest of the improved breeds. It originated in County of Berkshire, England, but principal improvement in it was made in Leicestershire and Staffordshire. The original animal was large, similar to the Tamworth, coarse of body, and the colour varied. Marked improvement developed early in the eighteenth century, and was principally effected by Richard Astley and Lord Barrington. The first-known pedigree dates from 1859. Berkshires were first to be given a separate class at the Royal Agricultural Show, England, in 1862. The first herd book was issued in 1885. Early writers show that Chinese pigs were crossed with the Berkshire in their improvement. The improved Berkshire was greatly used on native swine in Ireland and Scotland, with beneficial results. This breed is most widely distributed and popular throughout the world, and does well in all climates.

### *Quality of Meat.*

The Berkshire is noted for the high quality of its meat and the high proportion of the most profitable cuts which it yields. It is a producer of lean meat of the highest quality. The fact that the Challenge Cup for the best single pig of all breeds at the Smithfield Show has been awarded to Berkshires twenty times and to Berkshire crosses twice in forty years, and that the championship for the best pen of two pigs of all breeds was won by Berkshires twenty times and by Berkshire crosses eight times in forty-five years, affords further proof, if such were needed, that the breed is more than able to hold its own with others for early maturity. Weight for age is one of the prime requirements of judging at Smithfield; it is obvious that the breed would not have reached the top on so many occasions unless it had proved itself of inestimable value as a converter of food into meat in the least possible time.

Berkshires are hardy and may be relied upon to thrive under almost all conditions. In the Argentine, Australia, and New Zealand, countries in which the commercial aspects of live-stock breeding are alone of importance and where the most up-to-date methods are successfully employed, Berkshires constitute nearly two-thirds of the pure-bred population. This is a striking tribute to the suitability of the breed for all climates and conditions. In South Africa and Canada Berkshires are second in order of popularity; and they are found in increasing numbers in Central Europe, Japan, India, and the Malay States, as well as in Brazil and many other parts of the world. In the United States of America Berkshires have their own breed society, and it may be mentioned that at the International Live-stock Show, Chicago, held annually, Berkshires have sired over thirty champions and have won first prize in one or more classes twenty out of twenty-two years, a record unrivalled by any other breed.

### *Suitability for Crossing.*

The value of the Berkshire breed for crossing purposes, especially when sows are crossed with a Large White boar, is widely recognized. Whether either the boar or sow is used to mate with other breeds, the progeny may be relied on to bear the stamp of the Berkshire's fine quality and to inherit its early maturing properties.

The standard of excellence for the breed, which was revised in 1928, is as follows :—

*Character.*—A combination of the following definitions, denoting type, quality, breeding, and masculinity in the case of boars and femininity in the case of sows and gilts.

*Head.*—Moderately short, face dished, snout broad. Wide between the eyes and ears. Ears fairly large, carried erect or slightly inclined forward and fringed with fine hair. Jowl light.

*Neck.*—Fine, evenly set on shoulders and free from wrinkles.

*Shoulder-blades.*—Fine and well sloping. Special notice to be taken regarding this point in the case of females.

*Legs and Feet.*—Short, straight, and strong, set wide apart, standing well on toes, and a good walker.

*Back.*—Long and level. Tail set high.

*Sides.*—Level and deep, ribs well sprung.

*Hams.*—Broad, wide and deep to hock.

*Belly.*—Thick, with straight underline, and deep through the heart.

*Bone.*—Well developed in males and fine in females.

*Flesh.*—Firm without excessive fat.

*Skin.*—Fine and free from wrinkles.

*Hair.*—Long, fine, and plentiful, with absence of mane, especially in females.

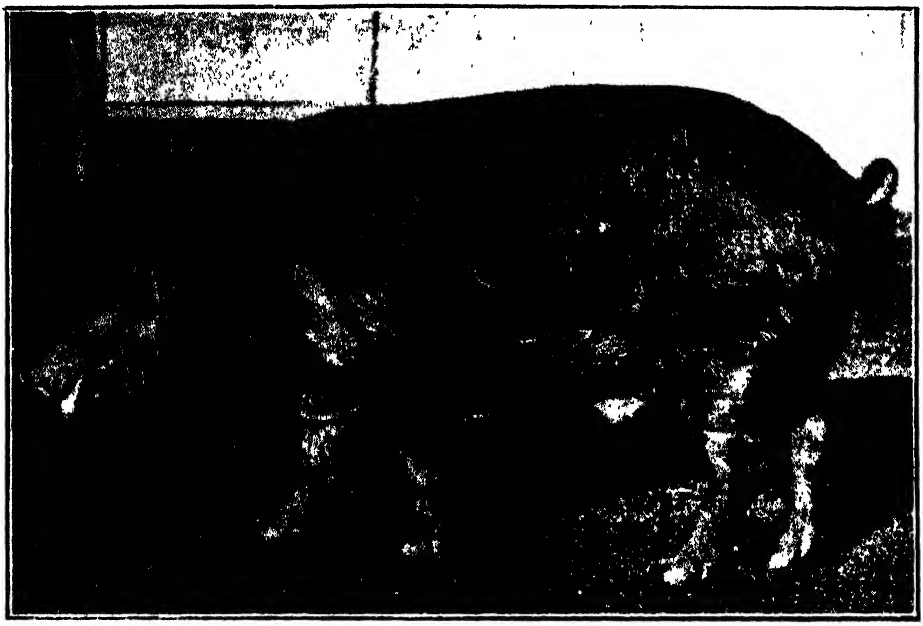
*Colour.*—Black, with white on face, feet, and tip of tail.

*Imperfections.*—Crooked jaw. Rose back

### THE TAMWORTH.

Next in popularity to the Berkshire and gaining rapidly on it is the Tamworth breed. Being a bacon pig and one of the oldest of the established breeds it has blended with the Berkshire to make a better bacon pig, and the offspring have shown the distinctive Tamworth characteristics of hardiness and ability to look after themselves in a most pronounced way. The demand for leaner bacon during the past twenty years has been a great factor in bringing the Tamworth breed into prominence and displacing some of the more refined breeds. The natural stamina, prolificacy, and grazing-capacity of the Tamworths, combined with the great delicacy, firmness, and succulence of their flesh for bacon, commend them to the farmer in this country, where pasturage and open grazing are abundant. The breed has the reputation of being slow in maturing, but such has not been the case in New Zealand. Evidently the nature of the climate has produced a reaction towards quick maturity, and in experiments carried out the Tamworth has more than held its own with other breeds. Where the Tamworth has proved specially valuable is in crossing with other breeds and further imparting vigour, size, and prolificacy to half-breds as produced. Tamworth sows are good mothers and free sucklers. They are also noteworthy for the facility with which they farrow, and the small trouble they have in rearing large litters. Again, Tamworths have acquired a reputation for docility. They are easily managed, and do not show any disposition to be ill-tempered.

*Tamworth Types.*



BOAR (ROYAL CHAMPION, 1936).

SOW (ROYAL CHAMPION, 1932).

[*N.Z. Farmer Weekly photos.*

Tamworths derive their name from the town of that name in Staffordshire, England, where they have been bred for a long period. They are probably the oldest and purest of all breeds in England, a circumstance that probably accounts for the wonderful marked prepotency of the Tamworth. At the beginning of the eighteenth century they were noted for large proportion of lean meat they produced. Have been greatly improved by selection, but it is generally conceded that no mixture of the breeds has been introduced in improvement. As early as 1847 they were given premier honours in competition with other large breeds at Royal Agricultural Show, England. Following this they went out of favour, but regained popularity from 1880 onwards.

### *Principal Points.*

The principal points of the Tamworth are as follows :—

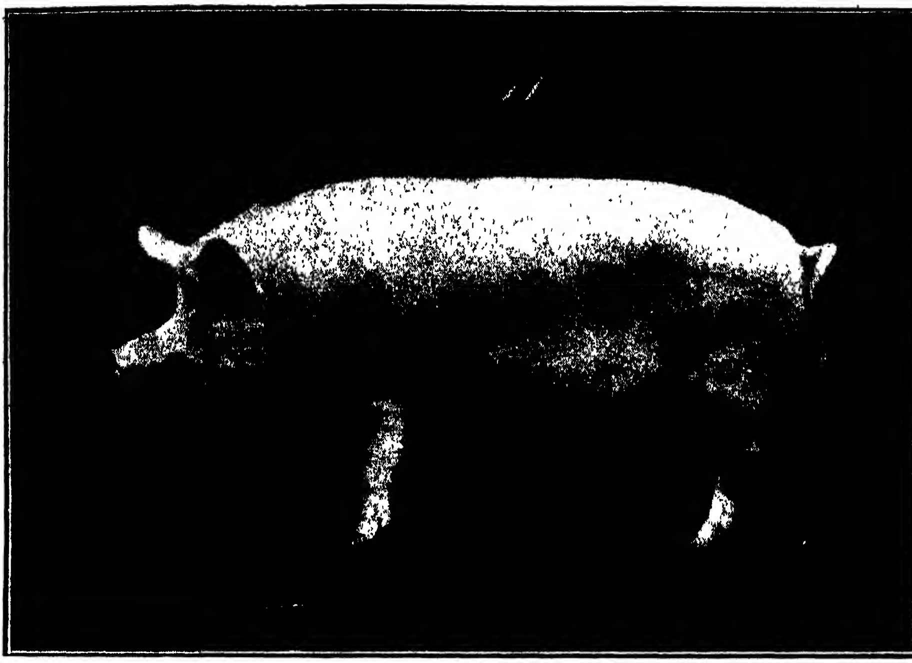
*Head.*—Long, lean, light, tapering to snout.
*Ears.*—Moderate size, fairly erect, pointing forward.
*Jowl.*—Light.
*Neck.*—Long, rather deep than wide, tapering.
*Shoulders.*—Sloping, good thickness through heart.
*Back.*—Moderately wide, long, slightly arched.
*Barrel.*—Long in coupling, deep ribs, well sprung.
*Rump.*—Deep, fairly full, rounded.
*Ham.*—Large, gradually rounded off rather than square.
*Legs.*—Moderately long, strong, firmly placed under body.
*Skin.*—Smooth, plentifully covered with hair.
*Hair.*—Freedom from coarseness.
*Colour.*—Bright golden red, no black.
*Objections.*—Shoulders coarse, open at top, ribs flat, weak coupling, shallow body.
*Disqualifications.*—Black or white hairs. Black skin.

### THE LARGE WHITE.

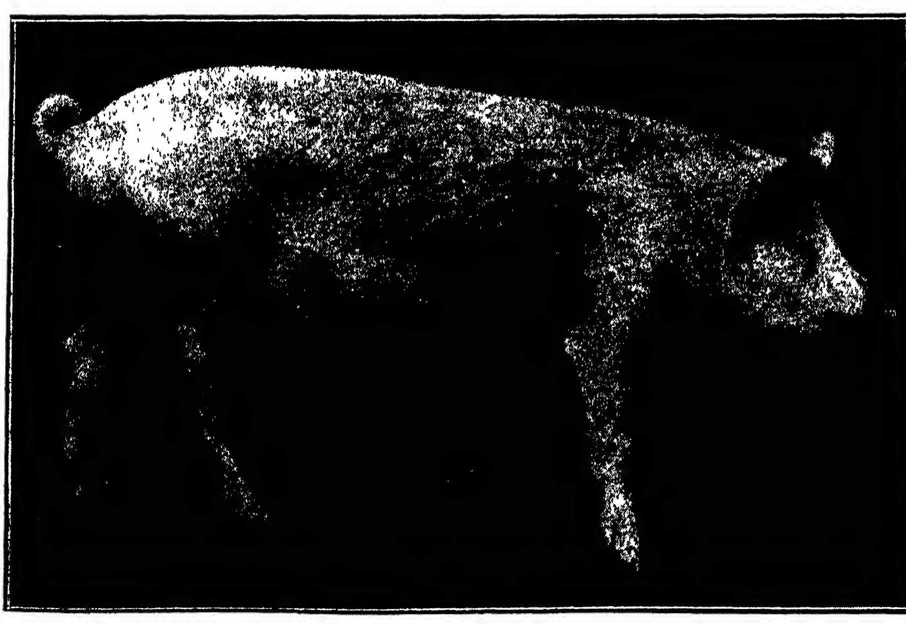
This is the world's bacon pig. In every country that is seriously producing bacon either one or else both the parents are Large White pigs. The White pig is the pig of the cold countries of the world, and, while this might infer considerable hardihood on the part of the White pig, it probably means a close association between these cold country people and their pigs. Possibly the White pig was well housed and cared for in these climates. Some say the Large White is a selection of the White Yorkshire pigs, the Small White being a selection from the same source. Other origins are attributed to these breeds, the Middle Yorkshire being reputedly a cross between Large and Small White Yorkshires. On the whole, New Zealand experience of White pigs has not been a happy one, although there are numerous exceptions to this generalization. Many have had White pigs that scald badly in hot weather or even in very rainy weather. When kept in the open, they are not always satisfactory, but it is an almost universal experience that the same pigs kept inside on warm beds grow more rapidly than any other breed or cross.

The Yorkshire originated in Yorkshire, England. It is bred from the old English hog, a large white animal. The Small Yorkshire owes its refinement to Chinese crosses, and the Middle Yorkshire to a cross

*Large White Types.*



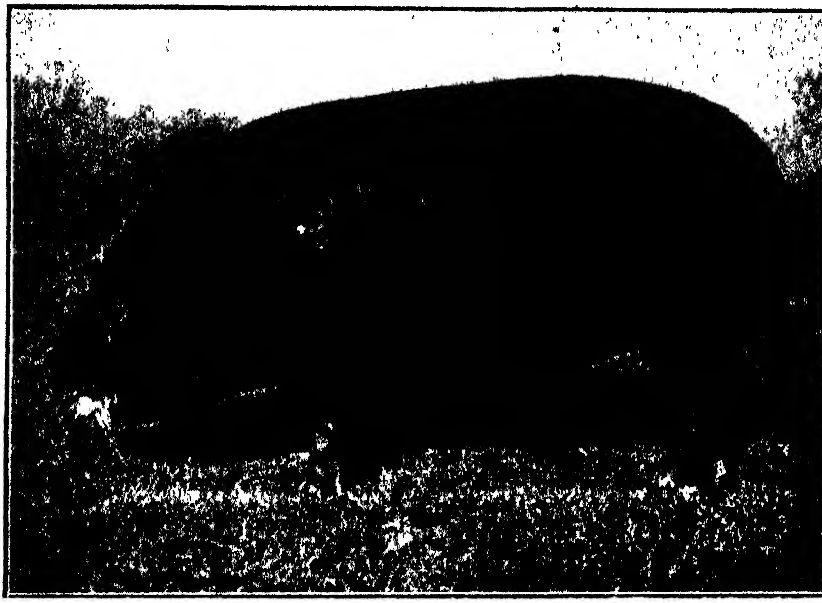
BOAR.



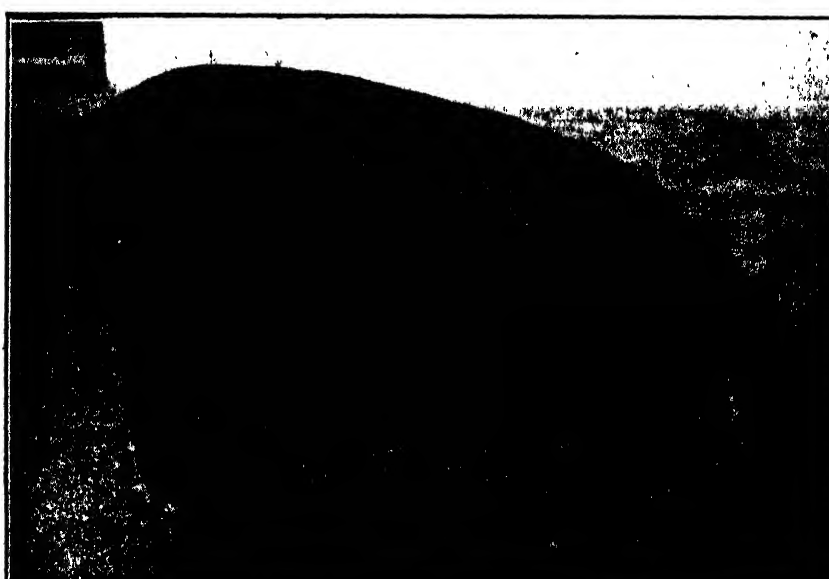
SOW (ROYAL CHAMPION, 1934).

[*N.Z. Farmer Weekly photos.*

*Large Black Types.*



BOAR (ROYAL CHAMPION, 1930).



SOW (ROYAL CHAMPION, 1936).

[*N.Z. Farmer Weekly photos.*

between the two. The Middle Yorkshire was classed separately in 1852. Improvement commenced about one hundred and fifty years ago. Yorkshire blood is widely diffused throughout the world in all white breeds.

*Principal Points.*

The principal points of the Large White are as follows :—

*Head.*—Long, lightish, wide between eyes, face dished.
*Ears.*—Long, fine, inclined forward.
*Jowl.*—Light.
*Neck.*—Long, muscular.
*Shoulders.*—Sloping, no coarseness.
*Back.*—Long, wide, straight or slightly arched.
*Barrel.*—Deep, full-rounded, well-sprung ribs, flanks well let down, long, wide, square.
*Hams.*—Broad, full meat to hocks.
*Legs.*—Straight and strong.
*Feet.*—Firm.
*Skin.*—Cream colour, freedom from wrinkles or dark spots.
*Hair.*—Long, straight, fine.
*Colour.*—Pure white
*Objections.*—Ears coarse, flopping ; shoulders, coarse ; weak back ; unshapely hams ; weak loins , crooked legs ; weak feet ; coarse, curly hair ; action, sluggish.
*Disqualifications.*—Black or red hair or spots on skin.

LARGE BLACKS.

Large Blacks are essentially bacon pigs. It is only with difficulty that they can be turned off as porkers. They are not sufficiently developed at the porker weight to produce a suitable carcass, being thin on the flank and usually loose over the loins. They are noted for their placid disposition and ability to forage.

Their origin is veiled in obscurity. There is no evidence of mixture of breeds. For generations the Large Black was the only pig known in Devon, Cornwall, Suffolk, and Essex. Its first herd book was started in 1899.

*Outstanding Points.*

The outstanding points of the Large Blacks are as follows :—

*Head.*—Medium length.
*Ears.*—Long, wide, falling over face, fine in texture.
*Jowl.*—Medium.
*Neck.*—Fairly long.
*Back.*—Long, broad, inclined to arch.
*Sides.*—Very deep.
*Ribs.*—Well sprung.
*Barrel.*—Ample capacity.
*Hindquarters.*—Long, wide, not drooping overmuch.
*Hams.*—Large and well filled.
*Legs.*—Comparatively short, straight, well placed.
*Skin.*—Fine, mellow to touch.
*Hair.*—Somewhat sparse, fine silky.
*Objections.*—Head, narrow, dished nose ; Skin and hair, coarse or curly.
*Disqualifications.*—Ears, thick, coarse, or erect ; colour, other than whole black.

Next month the breeding of pigs will be discussed.

# ARTHRITIS IN LAMBS.

A paper read by W. C. BARRY, Director, Live-stock Division, Department of Agriculture, at the Sixth Annual Meeting of Sheep-farmers held at Massey Agricultural College, June, 1937.

THE disease known as arthritis in lambs has been observed in New Zealand for years past, and many sheepowners are familiar with the lameness produced in young lambs by this joint infection.

Arthritis means inflammation of a joint. The actual lesion varies from a simple excess of synovial fluid or "joint oil" to a condition of thickening of the tissues of the joint capsule. The articular cartilages of the joint are sometimes involved, when erosion takes place. In chronic cases there is seen permanent enlargement with accompanying stiff joint. In a minority of cases of arthritis pus is found in the joint, but in those cases the infecting agent is usually one of the pus-producing organisms—streptococci or staphylococci. This form is, however, comparatively uncommon. In a majority of cases no pus is found in the joint, but the synovial fluid is increased in quantity in the early stages. It is with this form of arthritis, which is due to a specific organism, and which is by far the most common type of the disease met with, that this paper deals.

The disease is sometimes referred to as "joint ill," or polyarthritis of lambs. Its distribution appears to be world-wide. In England the disease was studied in 1925 by Glover and Cornell at the Institute of Animal Pathology, Cambridge. It has been described in Germany. In Montana, United States of America, the disease has been intensively studied by Marsh; in Australia by Seddon, Carne, and others; and in New Zealand by Hopkirk and Gill at the Wallaceville Laboratory, who in 1930 published a most interesting *résumé* of their investigations into the disease in this country. They then recorded for the first time in New Zealand the association of a particular germ—very similar to, if not identical with, that which causes swine erysipelas in pigs, and known as *Erysipelothrix rhusiopathiae*—with arthritis of lambs. It must not, however, be assumed from this that the disease is in any way connected with the pig, as swine erysipelas is practically unknown in New Zealand. The finding of a similar organism in cases of lamb arthritis was later recorded from other countries.

## ECONOMIC IMPORTANCE.

Arthritis of lambs is of considerable economic importance. It results in the partial condemnation of a large number of lamb carcasses at freezing-works during the killing season, the most commonly condemned portion being the leg, the stifle and hock joints being the most frequently involved. Along with enlargement of those joints, wasting of the muscles of the part occurs, spoiling the appearance of the leg. The knee is also frequently found affected. Meat-inspection records at freezing-works indicate that 0·138 per cent. of lambs are affected with arthritis. This means that for a season's killing approximately twelve thousand lambs are found affected with arthritis in some degree. Apart from the waste occasioned by condemnation of parts of affected carcasses, the disease is also responsible for economic loss to the sheepowner through

the setback which it brings about in affected lambs in a flock. Even when lambs are only very slightly affected and no symptoms are evident beyond a slight stiffness, which passes off in a few days, nevertheless such lambs receive a check in condition from which it takes them considerable time to recover.

The most susceptible age is up to three or four months, and the most common time when lameness among lambs is noticed is about a week to a fortnight after the lambs have been marked. The disease is occasionally seen in a flock before marking, but the majority of cases occur after that operation. The breed of sheep does not appear to have any relation to the disease ; it occurs in lambs of all breeds. It is held that a larger percentage of cases occur in wether lambs, and this is to be expected as the disease is generally supposed to be a wound infection, the inference being that the castration wound, in addition to the docking of the tail, offers an increased avenue of entry to the germ.

### Symptoms of Disease.

The symptoms of the disease are fairly well defined, and no great difficulty is experienced in diagnosis. Its onset in a flock of lambs is usually sudden. The owner notices a number of lambs affected with lameness in one or more limbs, and examination will reveal tenderness of the joints—usually the stifle, hock, knee, and elbow. It must, however, be remembered that stiffness and lameness can be present without enlargement of the joints—the latter symptom is not seen at all in a large percentage of the cases. The lamb shows evidence of pain when attempting to place weight on the affected leg. There is consequently disinclination to move, and, as a result, rapid loss of condition through partial starvation. From the first acute symptoms a sub-acute form is developed, and a small percentage of lambs become chronically affected. Complete recovery, however, usually takes place in probably 80 per cent. of the cases within a month of the onset of symptoms. Mortality might occur in a small percentage of cases, and is probably the result of generalized infection. In the chronic cases deformity of the joints usually results.

The organism which causes the disease is generally believed to gain entrance to the circulation through a wound—either the freshly ruptured or unhealed navel, docking, castration, or ear-marking wounds. Having entered the circulation the germ appears to have a predilection for the joints, where the characteristic lesions are set up. The large number of cases which occur about a week following marking would strongly support the view that it is a wound-infection. In the cases which occur in younger lambs, and before marking, there is every reason to believe that the infection gained entrance through the navel.

### Interesting Experiments.

In connection with the manner of infection, some interesting experiments were conducted by Hopkirk and Gill in 1928. An extract from their report is as follows : " Two ram lambs had the freshly-cut castration wounds sprayed with a culture of the organism, and three ewe lambs had the freshly-made docking wounds similarly treated. One ram lamb and three ewe lambs marked at the same time acted as controls. Lameness was noted in each of the three males and in two out of the six females

by the fifth day. The females showing lameness were two of the three whose docking wounds were sprayed. These nine lambs were operated upon in a small enclosure and the spray was made by an ordinary atomizer. As none of the lambs from the rest of the flock which were marked at the same time, but in another yard, showed any such symptoms it seems fair to regard them as controls and assume that the control male lamb which evinced arthritis was accidentally infected as a result of the spraying of the others. All marking wounds, sprayed and otherwise, healed quickly and normally without treatment. One ewe lamb showing obvious lameness at the expiration of three weeks was killed, and post-mortem showed acute arthritis of the limb joints. The specific organism was obtained in pure culture from one lamb, but the other two gave mixed growths. The other four affected lambs recovered from their lameness but did not thrive well, remaining culls till late in the season."

An experiment was also carried out by Hopkirk and Gill to illustrate infection through the navel. Each of a pair of twin lambs was inoculated, shortly after birth, into the tip of the navel string with a ½ c.c. emulsion of the arthritis organism. One lamb showed slight lameness affecting a hind limb two days later. Ten days later both lambs were markedly stiff in their movements, and, although getting plenty of milk, were not thriving. This continued, the lambs moving painfully about with the ewe, feeding well but remaining stunted. At three months old the lambs were killed, and post-mortem examination showed the characteristic joint lesions from which the specific organism was recovered.

### Outbreak on Farm.

The following details of an outbreak encountered on a farm is of interest: "The lambs had been marked in a pen beside the horse stables, and as each lamb was dealt with it was dropped over the fence into the stableyard, where it lay for a few moments in the dusty and soiled litter before wandering on through the yard and back to the pasture. When seen some eight days after the marking of 200 lambs about 20 per cent. were affected in various degrees. The marking wounds had healed cleanly. No treatment was undertaken, and in three weeks all except about 5 per cent. were again sound. The following year the same farmer marked his lambs in a new yard and placed them straight from this into a clean grass paddock. The result was that not a single case of lameness occurred amongst them."

Hadleigh Marsh, of Montana, United States of America, who has conducted a lot of work on this disease, carried out some experiments in 1933, designed to show the portal of entry of the germ. He showed clearly that inoculation of cultures of the organism into the navel of young lambs produced the disease. Further, it was shown that newly-born lambs kept in pens on bedding which had been sprinkled with cultures of the organism developed the disease. This clearly demonstrated that in very young lambs the channel of infection is through the umbilicus. In the same way exposure of the docking and castration wounds to infected bedding resulted in the lambs so treated developing arthritis.

Having discussed the manner in which lambs become infected, we now come to the most important consideration—namely, prevention of the disease. Curative measures are useless, but prevention is possible

if certain precautions are observed at marking-time. On farms where the disease is known to occur docking should be carried out on a fresh site, the yards previously used for this purpose being avoided. All instruments should be sterilized by boiling before use, and frequently immersed in antiseptic solution during the operations. (A 2-per-cent. solution of Lysol, Jeyes' fluid, &c., can be employed.) In selecting the site for temporary yards for marking, a well-grassed area should be chosen. After marking the lambs on a rail of the outer fence, care should be taken to place them on their feet and allow them to run away on a clean grass paddock.

### USE OF ANTISEPTICS.

Regarding the use of antiseptics: Too irritant solutions must not be employed. A 1-per-cent. solution (about 1½ oz. to the gallon of water) of any of the standard disinfectants (Lysol, Jeyes' fluid, &c.) will be sufficient. It is desirable to apply the solution to the skin of the purse and tail before castrating and docking are actually performed, as well as after. The use of a syringe by which the solution could be quickly "jetted" on to the parts by an assistant standing alongside the operator is worthy of consideration. Cleansing of the operator's hands and overalls must not be neglected.

Reference has been made to that form of arthritis which occurs before marking and in which the channel of infection is supposed to be through the navel. Preventive measures here will include antiseptic dressing of the navel string of newly-born lambs; for this purpose tincture of iodine is employed. This form of arthritis is, however, relatively uncommon It is questionable whether the preventive measures are practicable in large flocks at lambing-time.

The use of the emasculator or bloodless castrating instrument (one make of which is known as the "Daroux") gives satisfactory results when properly employed might be considered on farms on which arthritis in lambs is common. By its use one avenue of infection, the castration wound, is eliminated. With regard to docking, it is held that the use of the red iron is generally followed by less trouble, and it is probable that rapid searing of the tail after severance with the knife would prove useful in the prevention of infection.

## INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal*, include the following of agricultural interest. —

No. 77903: Seed-mixing attachment: A R Craddock No 77908. Milking-machine; R. J. Simpson. No. 77915: Wire-strainer; M. S Chalmers. No. 77934: Flax-treatment: Oonah Ltd. No 77957: Milk-cooler, E. Hoyland. No. 77959: Plow-coulter clamp; A. S. Shepherd.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

The Fields Instructor, Masterton, records that a farmer in the Akitio district has successfully established subterranean clover by broadcasting on rolling country without any form of cultivation. Two autumns ago 3 lb. of subterranean clover seed per acre was sown broadcast on a 200-acre paddock.

# PASTURE TOP-DRESSING IN THE AUCKLAND PROVINCE.

## EXPERIMENTAL WORK BY THE FIELDS DIVISION, PERIOD 1928–36.

P. W. SMALLFIELD, Fields Superintendent, Department of Agriculture, Hamilton.

DURING the twelve months ended 31st January, 1936, over 1,500,000 acres of grassland were top-dressed in the North and South Auckland Land Districts as follows :—

| | North Auckland. Acres. | South Auckland. Acres. | Total. Acres. |
|---|---|---|---|
| Fertilizers only .. | 289,915 | 614,277 | 904,192 |
| Lime only .. .. | 20,018 | 24,751 | 44,769 |
| Fertilizers and lime .. | 162,433 | 421,082 | 583,515 |
| | 472,366 | 1,060,110 | 1,532,476 |

Phosphates, chiefly superphosphate, formed almost the entire bulk of the fertilizers applied, and only about one-third of the land received lime in addition to phosphates. In the last review(1) of Auckland top-dressing trials the conclusions reached were : " The results of the top-dressing trials . . . confirm general farm practice. Superphosphate is generally the cheapest and most efficient phosphate for pasture top-dressing, but on some soils lime is necessary to enable the best results to be obtained from superphosphate. Slag is also quite efficient, but is not superior to superphosphate or superphosphate and lime. Rock phosphates are generally inferior to superphosphate or slag. Potash responses are not frequent, and, when responses are secured, they are generally slight." During the past two years experimental work has greatly extended our knowledge regarding the use of potash and lime. Bell(2) has described areas where very definite and payable potash responses are obtained ; and in other districts some slight potash responses have been recorded. Our knowledge regarding the use of lime has also increased, particularly through the work of the Soil Survey Division of the Department of Scientific and Industrial Research, enabling lime responses to be more definitely correlated with soil type.

### THE USE OF LIME.

" Can nobody give us an answer—the truth and the whole truth of the operation of lime upon soils ? "(3). So the question was framed eighty years ago, and now, although the whole truth still eludes us, the action of lime in improving soil fertility is better understood : it frequently plays a controlling part in soil fertility, preventing or correcting the conditions of " acidity " or " lack of basicity " (commonly called " sourness ") that are unfavourable to many cultivated plants. Acidity in a soil commonly occurs in wet climates and is caused by the washing-

FIG. 1.

Experiment 16/1/432 : Superphosphate plot on red-brown soil ; two autumn dressings of 3 cwt. of super ; response fair ; sward consists of a little rye-grass, white and subterranean clovers, brown-top, and plantain making poor growth.

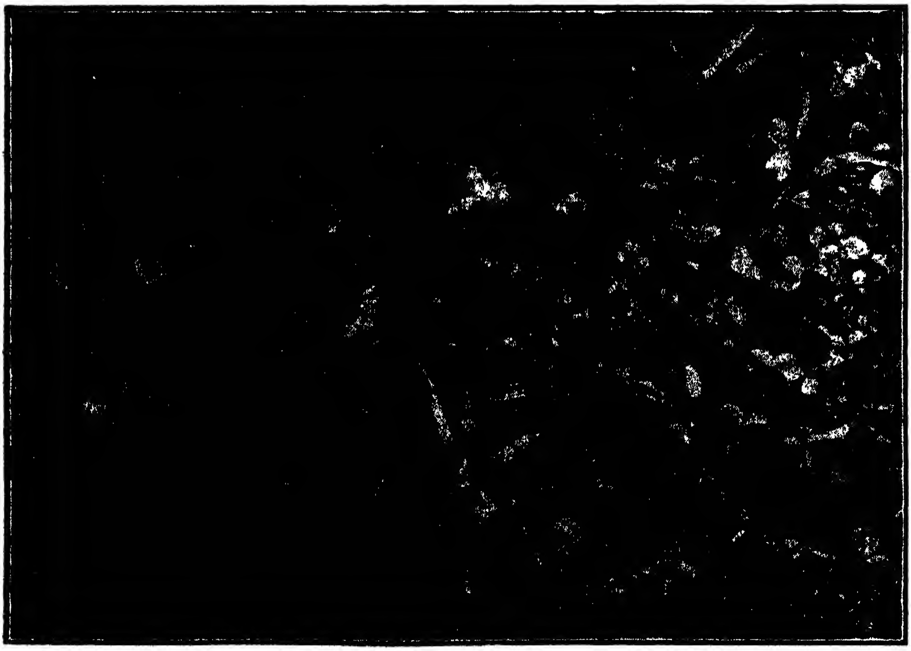


FIG. 2.

Experiment 16/1/432 : Slag plot on red-brown soil ; two autumn dressings of 3 cwt. basic slag ; response good ; dominant subterranean and white clovers with a little rye-grass and plantain making good growth. [*Photos, H. Drake.*

out of the bases from the original soil by percolating water. In acid soils soluble iron, aluminium, and manganese compounds are frequently present in sufficient quantities to injure plants, but so long as the soil reaction remains about neutrality the compounds of these metals present in the soil are practically insoluble and do not affect plant growth. This does not apply to red-brown-soil group, which may require lime although the soil is near neutrality. Although it is impossible to ascertain the amount of lime necessary for a soil except by actual field trials, the appearance of the soil profile—*i.e.*, the measure of soil leaching—is a fair guide as to whether a soil will or will not respond to lime. Young soils are not responsive to lime, leached soils are acid, frequently contain

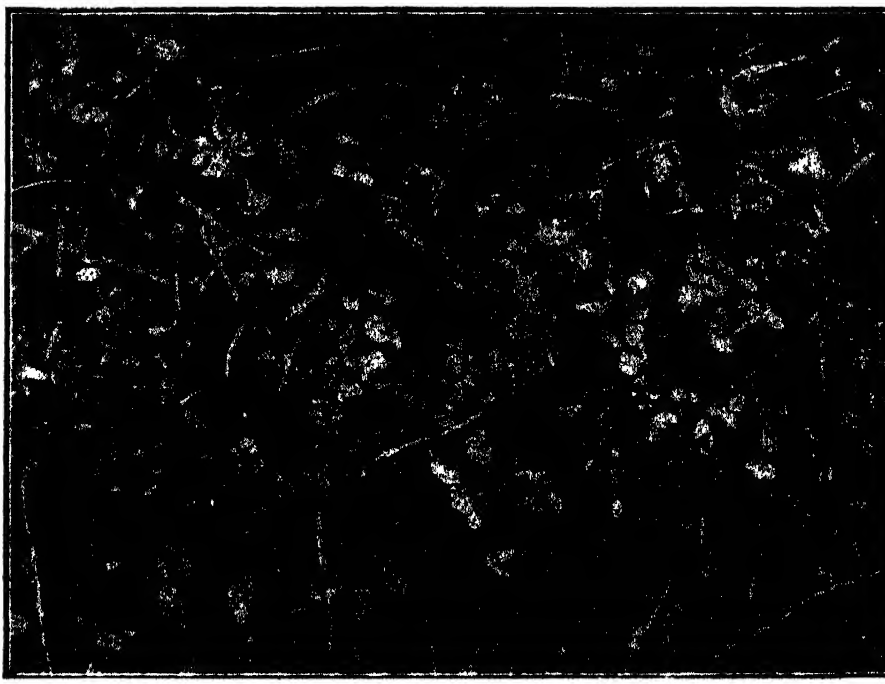


FIG. 3.

Experiment 16/1/432: Slag plus lime plot on red-brown soil; two autumn dressings of 3 cwt. of slag, one ton of lime at laying down and one autumn dressing of 5 cwt.; response very good; good sward of clovers and grass making a strong growth. [*Photo, H. Drake.*

toxic amounts of soluble iron and aluminium compounds, and respond to lime. This broad outlook on liming fits in quite well with the lime responses obtained in the Auckland Province. The young soils (volcanic ash showers) of the Bay of Plenty and Central Plateau do not respond to lime, the slightly podsolized soils of the Waikato give a slight response, and the mature podsols and red-brown soils of South and North Auckland show marked lime responses. The locality responses to lime and fertilizers are given in Tables I to V. In the Bay of Plenty super alone generally gave a good response, and in only three out of twenty-two trials did the addition of lime cause definite improvement. In the Central Plateau area super alone was consistently good, and only in one trial out of ten

did lime give an appreciable improvement; the effect of lime was often detrimental. Most of the trials in the Waikato were placed on land that had previously been top-dressed with phosphates for many years, and the relative response to phosphates and lime is not as marked as in other districts where top-dressing is a newer practice. As in the Waikato, the experiments in South Auckland were laid down on land previously top-dressed, and the response to superphosphate was relatively slight, particularly in the first year; on the clays and some of the red-brown soils lime and super has given better results than super alone. In North Auckland super and lime have given definitely better results than super alone.

FIG. 4.

Experiment 16/1/432: Super plus lime plot on red-brown soil; two autumn dressings of 3 cwt. of super, one ton of lime at laying down and one autumn dressing of 5 cwt.; response good; good sward of clovers and grass growing vigorously

[*Photo, H. Drake.*

## Potash and Phosphate Responses.

Except for the Waihi District(2) and some peat soils of the Waikato, potash responses are not very marked in Auckland. Trials laid down on sandy peat in North and South Auckland, although few in number, indicate that potash is a necessary fertilizer on this soil type. In the Waikato lime, super, and potash have given slightly better results than super and lime, and alternate mowing and grazing trials have now been established at Ruakura Farm of Instruction, Hamilton, to measure the lime, potash, and phosphate responses on the Hamilton clay loam, Horotiu sandy loam, and Te Kowhai loam soil types.

As has been quoted above, in the last summary of top-dressing experiments in Auckland the statement was made that "superphosphate

is generally the cheapest and most efficient phosphate for pasture top-dressing, but on some soils lime is necessary to enable the best results to be obtained from superphosphate. Slag is also quite efficient, but is not superior to superphosphate or superphosphate and lime." Further trials of super and slag have been carried out in North and South Auckland (red-brown soils and gumland podsols), and the results are given in Table VI. On these soils slag alone is better than super alone, lime and super is generally better than slag alone, super and lime and slag and lime are about equal, although there is an indication that slag and lime may be slightly better than super and lime.

## Experimental Plots.

The top-dressing plots were laid down in duplicate on farmers' fields and were kept under observation for periods of from two to four years. They were treated as follows: at laying down—(1) carbonate of lime, 1 ton per acre; (2) super or slag, 3 cwt. per acre; (3) 30 per cent. potash salts, 2 cwt. per acre. Annual top-dressing consisted of—(1) carbonate of lime, 5 cwt.; (2) super or slag, 3 cwt.; (3) 30 per cent. potash salts, 2 cwt. per acre. The arrangement of the plots was such as to give comparisons of each treatment and combinations of the above treatments with no manure. The method adopted to indicate the nature of the differences has been to award points based on visible responses as compared with no manure as follows: 0, no visible response; ?, doubtful response; 1, slight response; 2, fair response; 3, good response; 4, very good response; 5, excellent response; half points are also used—*e.g.*, 1½ = slight to fair.

*Table I.—Responses to Fertilizers: Bay of Plenty.*

| Trial. | Soil Type. | Responses to Fertilizers. (0, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.) Lime. | Super. | Potash. | Lime plus Super. | Super plus Potash. | Lime plus Super plus Potash. |
|---|---|---|---|---|---|---|---|
| 16/1/120 | Sandy loam .. | ? | 2 | 0 | 3 | 2 | 2 |
| 121 | ,, .. | 0 | 3 | ? | 3 | 3 | 3 |
| 124 | ,, .. | 0 | 3 | 0 | 3 | 3 | 3 |
| 139 | ,, .. | 0 | 3 | 0 | 3 | 3 | 3 |
| 140 | ,, .. | 0 | 3 | 0 | 3 | 3 | 3 |
| 141 | ,, .. | 0 | 3 | ? | 3½ | 3½ | 4 |
| 162 | ,, .. | 1 | 3 | 0 | 4 | 3 | 4 |
| 176 | ,, .. | 2 | 3 | 0 | 4 | 3 | 4 |
| 201 | ,, .. | 1 | 2 | 0 | 2 | 2 | 2 |
| 240 | ,, .. | ½ | 2½ | ½ | 2½ | 2½ | 3 |
| 254 | ,, .. | 0 | 2 | 0 | 2 | 2 | 2 |
| 255 | ,, .. | 0 | 2½ | 0 | 3 | 3 | 3 |
| 256 | ,, .. | 1 | 3½ | ½ | 4 | 4 | 4 |
| 257 | ,, .. | ½ | 3 | ½ | 3½ | 3½ | 3½ |
| 258 | ,, .. | ½ | 4 | 0 | 4 | 4 | 4½ |
| 261 | ,, .. | ? | 1½ | ? | 2 | 2½ | 3½ |
| 274 | ,, .. | 0 | 2½ | ? | 2½ | 2½ | 3 |
| 275 | ,, .. | 0 | 1½ | 0 | 1½ | 1½ | 1½ |
| 283 | ,, .. | ½ | 2 | ? | 2½ | 2½ | 2½ |
| 362 | ,, .. | 0 | 3½ | 0 | 3½ | 3½ | 3½ |
| 288 | Gravelly sand .. | 0 | 2 | 0 | 2 | 2 | 2 |
| 276 | Peat .. .. | ? | ½ | ? | 2 | 1½ | 2 |

*Table II.—Responses to Fertilizers: Central Plateau.*

| Trial. | Soil Type. | Responses to Fertilizers. (0, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Lime. | Super. | Potash. | Lime plus Super. | Super plus Potash. | Lime plus Super plus Potash. |
| 16/1/156 | Sandy loam .. | 1 | 4 | 1 | 3½ | 3½ | 3½ |
| 188 | ,, .. | 1 | 2½ | ½ | 3 | 3 | 3½ |
| 189 | ,, .. | —1 | 3½ | 1½ | 3½ | 4 | 4 |
| 190 | ,, .. | ? | 3 | 1 | 3½ | 3 | 3½ |
| 191 | ,, .. | —2 | 3 | 0 | 3½ | 3 | 3 |
| 203 | ,, .. | —1 | 2 | 1 | 3 | 4 | 3½ |
| 206 | ,, .. | 1 | 3 | 1 | 3 | 3½ | 3 |
| 207 | ,, .. | — ½ | 3 | ½ | 3 | 3 | 3 |
| 209 | ,, .. | 1 | 3 | ½ | 3 | 3½ | 3½ |
| 210 | ,, .. | 1 | 2½ | ? | 2½ | 3 | 2½ |

*Table III.—Responses to Fertilizers: Waikato.*

| Trial. | Soil Type. | Responses to Fertilizers. (0, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Lime. | Super | Potash. | Lime plus Super. | Super plus Potash. | Lime plus Super plus Potash. |
| 16/1/243 | Hamilton clay loam | 1 | 2 | 1 | 2 | 3 | 3½ |
| 251 | ,, | 1 | 3 | 1 | 3½ | 3½ | 4 |
| 252 | ,, | ½ | 1 | ½ | 1 | 1 | 1 |
| 422 | ,, | ½ | 2½ | ½ | 2½ | 3 | 3 |
| 423 | ,, | 1 | 2 | 1 | 2½ | 2½ | 3 |
| 239 | Horotiu sandy loam | ½ | 1½ | 1½ | 2 | 3 | 3 |
| 342 | ,, | ½ | 1½ | 2 | 2 | 3 | 4 |
| 346 | ,, | ½ | 2½ | ½ | 2½ | 3 | 3 |
| 374 | ,, | 1 | 1½ | ½ | 2 | 2 | 2½ |
| 376 | ,, | ½ | 1 | 1½ | 1½ | 2½ | 3 |
| 343 | Whatawhata clay loam | ½ | 2 | ½ | 2 | 2 | 2½ |
| 404 | Ditto .. .. | 1 | 2 | ½ | 2½ | 2½ | |
| 235 | Te Kowhai loam .. | ½ | 1 | ½ | 1½ | 1½ | 1½ |
| 236 | ,, .. | 1 | 1½ | ½ | 2 | 2 | 2½ |
| 344 | ,, .. | ½ | 1½ | 1 | 1½ | 2 | 2 |
| 375 | Rotokauri clay loam | 1½ | 2½ | ½ | 3 | 3½ | 3½ |
| 377 | ,, | 1 | 1½ | ½ | 2 | 2½ | 2½ |
| 378 | ,, | 1½ | 2½ | 1 | 3 | 3 | 3½ |
| 387 | Ohaupo silt loam .. | 1 | 2 | 2 | 2½ | 3 | 3 |
| 391 | ,, | 1 | 2 | ½ | 2½ | 2½ | 3½ |
| 393 | ,, | 1 | 1½ | ½ | 2 | 2 | 2 |
| 394 | ,, | 1½ | 2 | 2 | 2½ | 2½ | 3 |
| 242 | Peat .. .. | ½ | 1½ | 1 | 2½ | 2½ | 3 |
| 352 | ,, .. .. | ½ | 1½ | 2 | 2 | 3 | 3½ |
| 389 | ,, .. .. | ½ | 1½ | 3½ | 1 | 4 | 4 |
| 390 | ,, .. .. | ½ | ½ | ½ | 1 | 1 | 1 |
| 421 | ,, .. .. | 1 | 1½ | ½ | 1½ | 2½ | 2½ |

*Table IV.—Responses to Fertilizers: South Auckland.*

| Trial. | Soil Type. | Responses to Fertilizers. (0, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Lime. | Super. | Potash. | Lime plus Super. | Super plus Potash. | Lime plus Super plus Potash. |
| 16/1/263 | Silt | 0 | 3 | 0 | 3 | 3 | 2½ |
| 177 | Red-brown soil | 3 | 2 | ? | 4 | 2 | 4 |
| 178 | ,, | ? | 1 | 0 | 1 | 1 | 1 |
| 198 | ,, | ? | ? | .. | 1 | ? | 1 |
| 246 | ,, | 0 | ½ | 2 | ½ | 3 | 3 |
| 279 | ,, | 1½ | 2½ | ? | 4 | 2½ | 4 |
| 282 | ,, | 1 | 2½ | 0 | 3 | 2 | 2 |
| 285 | ,, | 1½ | 1½ | 0 | 3 | 1½ | 2 |
| 311 | ,, | .. | ½ | 2 | 1 | 2 | 3 |
| 313 | ,, | .. | 1½ | 0 | 3 | 2 | 3 |
| 314 | ,, | .. | ½ | 0 | ½ | 1 | 1 |
| 167 | Clay | 1 | 1 | 0 | 2 | 1 | 2 |
| 169 | ,, | 3 | ? | ? | 3 | ? | 3 |
| 195 | ,, | 3 | 1 | .. | 4 | 1 | 4 |
| 250 | ,, | 2 | 2 | 0 | 2½ | 1 | 4 |
| 318 | ,, | .. | 3½ | 0 | 4½ | 4½ | 4½ |
| 245 | Loam | ½ | 1 | 1½ | 1½ | 2½ | 2½ |
| 249 | ,, | ? | 3 | —1 | 3 | 2 | 2 |
| 286 | ,, | ½ | 2 | 0 | 2 | 2 | 2 |
| 289 | ,, | ½ | 0 | 1½ | 1 | 2 | 3 |
| 247 | Sand | 0 | 1 | 1½ | 1 | 2 | 2½ |

*Table V.—Responses to Fertilizers: North Auckland.*

| Trial. | Soil Type. | Responses to Fertilizers. (0, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Lime. | Super. | Potash. | Lime plus Super. | Super plus Potash. | Lime plus Super plus Potash. |
| 16/1/94 | Silt | 0 | 2 | 1 | 4 | 3 | 4 |
| 147 | ,, | 1 | 1½ | ? | 2 | 3 | 5 |
| 181 | ,, | 1 | 2 | 1 | 3 | 2 | 4 |
| 297 | ,, | 1 | 2½ | 0 | 5 | 2½ | 4 |
| 298 | ,, | 1 | 2 | 0 | 3½ | 2 | 3½ |
| 317 | ,, | 1 | 1 | 2 | 2 | 2½ | 3 |
| 373 | ,, | .. | 1½ | 0 | 2½ | 1 | 3½ |
| 384 | ,, | .. | 2 | ½ | 3½ | 2 | 4½ |
| 160 | Red-brown soil | 2 | 2 | 0 | 4 | 3 | 4 |
| 180 | ,, | 1 | 2 | ? | 3 | 3 | 4 |
| 184 | ,, | 2 | 2 | ? | 3 | 1 | 3 |
| 266 | ,, | .. | 2 | 0 | 2½ | 2 | 3½ |
| 267 | ,, | .. | 1½ | ½ | 2½ | 2 | 3½ |
| 269 | ,, | .. | 2 | 0 | 3 | 2 | 3 |
| 271 | ,, | ½ | 1½ | ½ | 2 | 2 | 2½ |
| 316 | ,, | 1 | 2½ | 1 | 4 | 2½ | 4½ |
| 383 | ,, | .. | ½ | 0 | 2½ | 2 | 2½ |
| 385 | ,, | .. | 2½ | 0 | 3 | ½ | 2½ |
| 427 | ,, | .. | ½ | 0 | 2 | ½ | 2½ |
| 428 | ,, | .. | 1½ | 0 | 2½ | 1½ | 3 |
| 431 | ,, | .. | 1½ | 0 | 2½ | 2 | 3 |
| 432 | ,, | .. | 2 | 0 | 3 | 2 | 4½ |

*Table V*—continued.

| Trial. | Soil Type. | Responses to Fertilizers. (o, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.) Lime. | Super. | Potash. | Lime plus Super. | Super plus Potash. | Lime plus Super plus Potash. |
|---|---|---|---|---|---|---|---|
| 16/1/492 | Red-brown soil .. .. | .. | 1½ | ½ | 2½ | 1½ | 3 |
| 98 | Clay .. .. | o | 3 | o | 3 | 3 | 3 |
| 132 | ,, .. .. | 1 | 2 | 1 | 3 | 3 | 3 |
| 183 | ,, .. .. | 4 | 1 | ? | 5 | 1 | 5 |
| 185 | ,, .. .. | 2 | 1 | 1 | 3 | 3 | 3 |
| 260 | ,, .. .. | 1½ | 3 | o | 5 | 2½ | 4½ |
| 265 | ,, .. .. | .. | 1½ | o | 2½ | 2 | 3 |
| 278 | ,, .. .. | .. | 2 | o | 3 | 1 | 3 |
| 280 | ,, .. .. | .. | 3½ | 3 | 4 | 3 | 4 |
| 290 | ,, .. .. | 1 | 2 | o | 4 | 2½ | 4 |
| 293 | ,, .. .. | o | 2 | o | 2½ | 2 | 2½ |
| 315 | ,, .. .. | 1½ | 2 | o | 3 | 2 | 3 |
| 291 | Loam .. .. | ½ | 3 | o | 4 | 3 | 4 |
| 292 | ,, .. .. | ? | 2 | o | 2½ | 2 | 2½ |
| 294 | ,, .. .. | 1 | 4 | o | 5 | 4½ | 5 |
| 295 | ,, .. .. | ½ | 3 | o | 3½ | 2½ | 3 |
| 268 | Sand .. .. | ½ | 2½ | o | 3½ | 3 | 3½ |
| 281 | ,, .. .. | .. | 3 | 1 | 3½ | 3 | 4 |
| 270 | Sandy peat .. | ½ | 4 | ? | 4 | 4 | 4½ |
| 284 | ,, .. | .. | 2 | 1 | 3 | 4 | 4½ |

*Table VI.—Responses to Fertilizers: North and South Auckland.*

| Trial. | Soil Type. | Responses to Fertilizers. (o, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.) Slag. | Super. | Lime plus Super. | Lime plus Slag. | Lime plus Super plus Potash. | Lime plus Slag plus Potash. | Potash. |
|---|---|---|---|---|---|---|---|---|
| 16/1/373 | Silt .. .. | 2½ | 1½ | 2½ | 3½ | 3½ | 4½ | o |
| 384 | ,, .. .. | 3½ | 2 | 3½ | 3½ | 4½ | 5 | ½ |
| 266 | Red-brown soil .. | 2½ | 2 | 2½ | 2½ | 3½ | 3½ | o |
| 267 | ,, .. | 3 | 1½ | 2½ | 3 | 3½ | 4 | ½ |
| 269 | ,, .. | 2 | 2 | 3 | 3 | 3 | 3½ | o |
| 311 | ,, .. | o | ½ | 1 | o | 3 | 1½ | 2 |
| 313 | ,, .. | 2 | 1½ | 3 | 3 | 3 | 3 | ? |
| 314 | ,, .. | o | ½ | ½ | o | 5 | 5 | 1 |
| 383 | ,, .. | 2 | ½ | 2½ | 2½ | 2½ | 3½ | o |
| 385 | ,, .. | 2½ | 2½ | 3 | 3 | 2½ | 4½ | ½ |
| 427 | ,, .. | 2½ | ½ | 2 | 3 | 2½ | 3½ | o |
| 428 | ,, .. | 2 | 1½ | 2½ | 3 | 3 | 3½ | o |
| 431 | ,, .. | 2 | 1½ | 2½ | 2½ | 3 | 3 | o |
| 432 | ,, .. | 3 | 2 | 3 | 4 | 4½ | 4½ | o |
| 492 | ,, .. | 2½ | 1½ | 2½ | 3 | 3 | 3½ | ½ |
| 265 | Clay .. .. | 2½ | 1½ | 2½ | 3 | 3 | 3½ | o |
| 278 | ,, .. .. | 2½ | 2 | 3 | 3 | 3 | 3 | o |
| 280 | ,, .. .. | 4 | 3½ | 4 | 4½ | 4 | 4½ | o |
| 318 | ,, .. .. | 4 | 4 | 4½ | 4 | 4½ | 4½ | o |
| 284 | Sandy peat .. | 2½ | 2 | 3 | 3 | 5 | 5 | 1 |

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# SCIENTIFIC TESTING OF DAIRY-PRODUCE FOR EXPORT.*

## A BRIEF HISTORICAL REVIEW.

G. M. MOIR, Dairy Laboratory, Wallaceville.

ABOUT half a century ago, when our dairy industry was in its infancy, the difficulties which beset the pioneers were immense by comparison with those of the present day. In order to overcome the obvious lack of knowledge which prevailed, the Government of the day recognized the necessity for a dairy instructional service as part of State assistance toward the development of agriculture. Every effort was made to obtain men of experience for this work, but owing to the lack of knowledge, both scientific and practical, the early officers were often thrown upon their own resources in trying to discover the most suitable procedures. To-day a large amount of experience is available to indicate, for example, the most suitable temperatures for various manufacturing operations and storage conditions. Much of this experience is based upon the methods of trial and error which the early instructors were forced to adopt, often without the facilities either for precise control provided by modern refrigeration or of systematic procedure as applied in present-day scientific investigation. By the careful and persistent efforts of the instructors, in co-operation with factory-managers and farmers, many of the early problems were solved one by one. Thus the instructional, grading, and testing system has been gradually built up to function as smoothly and efficiently as it does to-day.

Contrary to the prevailing impression that only within the last few years have efforts been made to apply science to dairying in New

* This article is the substance of a paper which was read at the Auckland meeting of the Australian and New Zealand Association for the Advancement of Science in January, 1937.

Zealand, it can truthfully be asserted that from the earliest times such scientific methods as were available were introduced. To support this statement many examples could be cited, but two outstanding ones are the Babcock test and the acidimeter. The Babcock test was introduced to New Zealand in 1892, only two years after it was devised in America by Dr. S. M. Babcock, while the acidimeter was introduced thirty-five years ago by Mr. W. M. Singleton, now Director of the Dairy Division. In his original bulletin he records that the test was devised in 1899 by the English cheddar-cheese expert, Professor F. J. Lloyd, and was first used abroad at the Kingston Dairy School, Ontario. In addition to sound practical experience before his arrival in New Zealand, Mr. Singleton, in his dairy-school training, had opportunities of becoming conversant with the most up-to-date scientific information then available. He was, in fact, one of a number of overseas experts such as Messrs. Ruddick, Kinsella, Petersen, Sorensen, and others who were brought to this country to assist in the early development of the dairy industry. Many examples, past and present, could be cited of men who have been anxious to have more scientific assistance. This thirst for knowledge, which from the beginning possessed the leaders of the dairy industry, shows that they recognized the value of applying science to practice. Their close contact with practical conditions enabled them also to realize the difficulties which stood, and to-day still stand, in the way of attaining this ideal.

#### Early Scientific Work.

Early reports of the Department of Agriculture show that the Dairy Division frequently had the assistance of the Department's scientific staff, particularly Dr. J. A. Gilruth for bacteriological work, and Mr. B. C. Aston for chemical work. For example, standard alkali was supplied free of charge to factories from the Department's chemical laboratory to encourage the introduction of the acidimeter. In later years a considerable amount of work was undertaken for the Division by this laboratory, whose chemists supervised much of the early testing-work in the grading stores. In this connection mention should be made especially of the services rendered by the late Mr. F. T. Leighton, who took a great interest in dairy-work. The time of these officers was, however, often taken up with other duties, so that the Dairy Division did not get nearly as much scientific assistance as it required. This is made clear by the following quotation from the annual report of the Dairy Commissioner, Mr. J. A. Kinsella, in 1901: "No proper departmental facilities exist for carrying out such investigations on scientific lines." It was not until 1928 that Mr. G. F. V. Morgan was appointed to the Dairy Division to undertake bacteriological testing of faulty produce. In spite of the fact that the Dairy Division is still to-day, as it was in Mr. Kinsella's time, lacking in scientific assistance, appreciable progress has been made, and many useful investigations have from time to time been carried out and recorded on the departmental files without further publication. Failures have been forgotten, and successful methods applied to daily practice.

Referring again to the acidimeter for the titration of whey during cheesemaking and of cream in buttermaking, its value to the industry can scarcely be assessed. Simple as the test appears, it is not without pitfalls. One of the commonest mistakes which was pointed out in Mr. Singleton's original publication is that of titrating to too deep a

shade of pink. Notwithstanding the constant efforts of the Dairy Instructors this fault still occurs, especially in butter-factories, as Mr. G. M. Valentine's bulletin points out, but a method of checking this is now available, and is described later.

For a time after the introduction of the fat test, the accuracy of all the glassware used for milk and cream testing in the factories was checked in the Department's chemical laboratory. For some years this has been checked in the grading stores. In the early development of the test-room work a great deal had to be done with very primitive facilities. To-day many improvements have been introduced and better equipment provided in the testing-rooms. In Auckland, where very large amounts of butter are dealt with, facilities are being provided for the introduction of various special tests which will be referred to later.

## Cheese Investigations.

Some very useful information can be obtained about cheese by ascertaining its content of fat, moisture, and solids-not-fat. The first work of this kind was initiated about twenty-five years ago under the supervision of Mr. W. E. Gwillim. Several accounts of the early results were published by him in the *N.Z. Journal of Agriculture*, 1913, Vols. VI and VII, from the former of which the following quotation is taken :—

"The main objects of the examinations were to try to ascertain (1) to what extent the principal constituents of the cheese varied in the makes of the different factories, (2) whether the fat content was in conformity with the legal standard, (3) and whether knowledge of the chief component parts of the cheese would have any useful influence in assisting the grader to a better understanding of the merits or otherwise of the body and texture at the time of grading. . . . The content of moisture was ascertained by drying in a steam-jacketed oven, and the fat content by the Babcock method. Exception may be taken to these methods, but there are good grounds for believing that the results obtained are good and accurate enough for all practical purposes."

Systematic testing of cheese for moisture and fat content came into prominence during the period in 1929–31 when standardized cheese was made, and control was necessary to ensure that no cheese with less than 50 per cent. of fat in the total solids was exported. Although standardizing was stopped a certain amount of this work has been continued, chiefly for the purpose of checking factories which have unjustifiably high yields. At Wallaceville a simple grating machine for shredding the cheese has been found very convenient for obtaining a homogeneous sample. Such graters are now regularly used in all testing-rooms. By using also a suitable sampling tube to take portions of equal size from different plugs it is possible to prepare composite samples from several vats of cheese and thereby reduce the number of tests required. Cheese thus grated is in a very suitable form for drying, and also for fat tests by the Babcock method. Since the introduction of this system, samples of every vat of cheese at all the principal grading stores are taken and included in the Babcock test for fat. As the latter method has long been considered to give slightly lower figures, the use of a little normal butyl alcohol was suggested in order to improve the results. Tests carried out in the Auckland grading store

by Mr. A. G. Frieberg have shown that ¼ ml. of this alcohol per test gives improved accuracy when the results are compared with those obtained by the Werner-Schmidt method.

For salt tests upon cheese Dr. F. H. McDowall's method has been modified to enable it to be used in the grading stores, where it is occasionally applied. A few years ago many samples of cheese were examined at Wallaceville to see whether a pH test could be used to select cheese with too little or too much acid. Eventually the conclusion was reached that the grader's judgment of the colour was very reliable and much quicker. The same may be said of certain other chemical tests which may be useful to confirm the grader's judgment in special cases.

During the early stages of the establishment of the casein industry attention was given to various tests which might be suitable for assessing the quality of the casein. Eventually a borax solubility and pH colour test was devised by Mr. W. R. Mummery of the New Zealand Casein Co., who used it, in collaboration with Mr. J. W. Smith of the Division's Instructional staff, to indicate whether the casein had been properly treated in the factory. The regular use of this test in the grading stores enabled the stage to be reached when only a very small proportion of the samples failed to attain the standards specified in the method.

### Moisture in Butter.

In the testing of butter consideration was early given to its moisture content. Thirty years ago a great deal of the butter exported had a water content several per cent. below that permitted (16 per cent.). When factories attempted to increase the water content, churnings were sometimes made with too much water. Systematic testing was required to check this, and eventually it was found necessary to test every churning. To-day an immense amount of work is involved in testing 186,000 samples annually, but this ensures that no butter is exported with excess moisture. Not very long ago serious complaints were made in London about the large quantities of overmoist butter arriving from a certain country, where the testing is not as thorough as in New Zealand. Systematic testing has for many years safeguarded our reputation in this respect. Overmoist butter is returned to the factory to be reworked, and is again tested before it can be exported.

Many years ago the salt content of butter was determined by dissolving the fat in acetone and titrating with silver nitrate. This was superseded by the method devised by Sammis, which, it may be mentioned, was recommended by Mr. W. E. Gwillim in 1913, and is still regularly used. It consists of the titration of an aliquot with silver nitrate and chromate, so that the burette reading gives the salt percentage. The method is rapid and reasonably accurate for practical purposes, and if necessary can be made more accurate by a simple modification. We have recently endeavoured to perfect an electrical method which is even quicker than the titration method. With adequate temperature control this gives very good results, but some difficulty has been experienced in maintaining the electrodes free from interference with fat and casein particles.

At one time certain overseas markets allowed boric acid preservative in butter while others did not. The latter required a certificate of

freedom from boric acid, and for this purpose the test with turmeric paper was applied to the serum of the butter in question. Testing is no longer necessary, as the use of boric acid has been discontinued since it was prohibited by British regulations in 1928.

In addition to the tests needed to satisfy the requirements of those to whom we export our butter, administrative considerations have necessitated the analysis of regular samples for fat and curd content. In this way a check can be kept upon certain creameries which have been found to export in their butter more butterfat than they purchase from their suppliers. For these tests the Kohman method is used, whereby, after heating to dry off the moisture, the melted fat is dissolved in petrol and decanted after allowing the curd to settle. The idea of using one of the new non-inflammable solvents for this purpose proved impracticable, owing to its high specific gravity, which prevented a satisfactory separation of the curd particles. The risk of fire can be reduced by using a high-boiling petroleum spirit which does not contain the more volatile fractions present in ordinary petrol.

### Deterioration of Butter.

In New Zealand dairy practice it has long been realized that acid butters were liable to deteriorate seriously when stored. Reduction of the acidity of the cream with bicarbonate of soda avoided this. The use of excess of soda gave butter of quite remarkable keeping quality but at the sacrifice of flavour, which, if not actually recognized as alkaline, was often complained of as flat and neutral. Thus arose the desirability of a simple and rapid test to indicate the alkalinity of butter. The first work of this kind was done in 1932 in the Division's test-room at Castlecliff, Wanganui. There Mr. F. Bishop applied to butter the brom-thymol-blue indicator method used for casein-testing. Officers of the Dairy Division later drew Dr. McDowall's attention to this procedure, and he made a series of experiments using both brom-thymol-blue and phenol-red. In such tests the principal difficulty is that the butter serum, to which the indicator is added, is a milky liquid, while the standards are clear. At Wallaceville a means was eventually devised of preparing standards which are of a somewhat milky nature similar to the butter serum with indicator. These have now been in use for some time at several of the grading stores. The colour tests are very valuable for sorting purposes to enable the selection of butters which are too acid or too alkaline, and these are now frequently retested in Auckland by the more accurate electrical method. When due allowance is made for the difficulties, the agreement obtained is quite satisfactory. These tests provide the graders with a means of confirming their opinions about butters which are too acid due to the excessive use of starter, or too alkaline due to the excessive use of neutralizer. Thus careless use of the acidimeter in butter-factories can be checked.

For many years it has been realized that contamination of butter with iron or copper was a cause of serious defects. On occasions an experienced grader has been able to say that a certain butter owed its defective flavour to copper contamination, this being confirmed by a visit to the factory. Notwithstanding the skill of the graders, such a method has its limitations. Except for the work of Mr. W. Williams of the New Zealand Co-operative Dairy Company's Laboratory, very little has been done by way of systematic testing of our butter for metals. In the past this has been due partly to lack of staff and partly to the

difficulties of the methods available. The wet or dry ashing of butter is not an easy process, especially when the metals sought are present to the extent of only one or two parts per million, or even less in the case of copper.

Consideration has for some time been given to the possibility of developing a filtration method which would eliminate the necessity for ashing. Until the assistance of Mr. E. D. Andrews was available, insufficient time could be devoted to overcoming the many difficulties. After much careful work a suitable method has been evolved, whereby very satisfactory results can be obtained in estimating the iron content of 10-gram samples of butter, the operations being completely carried out in small centrifuge tubes and test-tubes. This method is now in use in the grading store in Auckland. By using larger centrifuge tubes we have the advantage of dealing with 25-gram samples. A similar method has also been evolved for the estimation of the copper content, for which 25-gram samples are essential. As a rule these filtration methods give better agreement of duplicates than the ashing procedure. The results so far obtained show that very few creamery butters approach the danger point in iron content. This is a tribute to the activities of factory-managers and Instructors in checking the use of rusty cream-cans. Regarding copper content, the position is not quite so satisfactory, but regular testing should enable the Instructors to track down badly tinned equipment.

### Flavour Problem.

In one or two cases complaints of metallic flavour in butter have been investigated and evidence obtained that the trouble was of bacterial origin, due probably to the presence of lipolytic or fat-splitting bacteria. Thus we come to the question of the bacterial content of export butter. Although it has not so far proved possible to arrange for bacterial examinations to be done in the grading stores, samples are now regularly taken in sterile fashion in both Auckland and Wellington and forwarded to the laboratory at Wallaceville. Space does not permit of a detailed account of this work. With the assistance of Mr. R. R. Russell, simplified methods have been devised to ascertain the total count, the yeast and mould count, the count of fat-splitting germs, and the coliform content. Using these improved methods we have examined over a thousand samples of butter during the past year. The results obtained are now being regularly forwarded to the Division's Instructors to enable them to draw the attention of factory-managers to cases where the bacterial condition of their butter (and therefore of their equipment) is not what it ought to be, even though the butter may be grading well. Among other things these tests show that very few butters indeed actually contain moulds. Even surface samples rarely show mould infection. This trouble is apparently due to mouldy box timber from which the infection spreads under bad storage conditions.

This review indicates briefly the progress that has been made in the past and makes clear that there is still a great deal to be done. So long as we export dairy-produce faults will arise, and there must be increasing use of scientific tests to track these down so that our reputation for high quality can be maintained. It is unlikely that any of these tests can be used to grade the produce, but they are best applied to discover the reasons for faults which the graders detect, or which may develop after storage. Especially in regard to butter, the new testing methods described are in advance of those hitherto used either in New Zealand or in any other country.

# THE TOMATO MITE (*Phyllocoptes* sp.).

W. COTTIER and G. G. TAYLOR, Plant Diseases Division, Plant Research Bureau, Department of Scientific and Industrial Research.

DURING October, 1936, tomato-growers in the Auckland District reported the occurrence of a disease on glasshouse tomato-plants, the cause of which was unknown. Examination of diseased plants revealed the presence of numerous small mites, specimens of which were sent to the Imperial Bureau of Entomology, London, and were identified by Dr. A. M. Massee as *Phyllocoptes lycopersici* Tryon.

FIG. 1. MITES ON THE SURFACE OF A TOMATO-FRUIT.
Note the spherical shining eggs scattered through the colony. × 66.

Dr. Massee pointed out that the mite was first recorded by Tryon (1917) as a pest of tomatoes in Queensland, Australia, and that although it was named no specific description was supplied. Therefore the name used is invalid and the mite is here referred to as *Phyllocoptes* sp.

## APPEARANCE OF THE MITE AND SYMPTOMS OF ATTACK.

The mites are small and can be seen clearly only under magnification (Fig. 1). They are elongated in shape and move by means of four legs placed at the head end of the body. The colour is cream in the adult form, and somewhat lighter in shade in the nymph stages. The mites

aggregate on the surface of the plants in large numbers, and to the naked eye have the appearance of fawn-coloured dust. The eggs are about one-quarter the size of the adults. They are round, smooth, white, and shining, and are deposited abundantly on the surface of the infested areas.

Infestation may occur at any stage of growth, but the presence of the mites usually is not apparent until the plants are well established. The powdery masses of mites are first apparent on the lower part of the main stems and on the adjacent leaf-stalks. Later the colonies migrate in an upward direction on to the leaves, stems of fruit bunches, and finally on to the fruit. As the mites spread and grow in numbers the stem develops a smooth, bronze-coloured appearance, due to injury to the epidermis and to destruction of the epidermal hairs.

The plants become stunted and pallid, whilst the more severely attacked leaves wither and die. Plants which are young at the time of infection usually become severely damaged and eventually die; on older plants spread of the mites may not be so extensive, but loss of crop usually occurs from reduced yield and damage to the fruit. Where the fruit is attacked a rough brown russet develops in the skin, accompanied by small cracks parallel to the circumference of the fruit, resulting in a characteristic "ringed" appearance.

## Incidence of the Disease and Economic Importance.

Morgan (1935) states that the first authentic record of the mite in New South Wales, Australia, was in 1929, although he considers it probable that the mite was there for several years prior to this. In that State the mite has been found on both glasshouse and outdoor tomato-plants.

In New Zealand during the summer of 1936–37 a survey was made of the glasshouse tomato crops grown in the vicinity of Auckland. Most of the crops were found to be clean, but isolated cases of attack occurred in the Avondale, Blockhouse Bay, Otahuhu, and Birkdale districts. The degree of infestation varied on different properties; in some instances only a few plants were attacked, while in the most severe case four houses were involved, in one of which over 50 per cent. of the plants were heavily infested. Several growers reported previous experience of the disease. From the evidence obtained it would appear that the pest first occurred in severe form in the autumn crops of 1935, although the cause of the disease at that time was not recognized. The pest has not been reported from any of the tomato-growing centres other than Auckland, where it has appeared only on glasshouse crops of tomatoes.

## Life-history, Over-wintering, and Spread.

The life-history of the pest has not been fully investigated. That the mites pass through their life-cycle rapidly is indicated by the observed fact that a small initial infestation may become acute within a few weeks.

Carry-over from one crop to another occurs most readily in those houses where two crops are grown in rapid succession each year. In certain cases, however, houses have been replanted within three weeks of the removal of an infested crop without any subsequent attack by

the pest. That the mites can over-winter in an unheated house seems probable, since live mites were found in the spring on old plants of an abandoned crop which had been heavily infested in the previous autumn.

Spread to glasshouses in which the mite has not previously been present may occur on the hands, clothing, &c., of visitors from infested houses or by the introduction of seedlings from infested nurseries. Once established the mites spread rapidly to healthy plants, and since they are relatively inert it would appear that the principal agents of distribution are the hands and clothing of workmen when pruning, cultivating, &c.

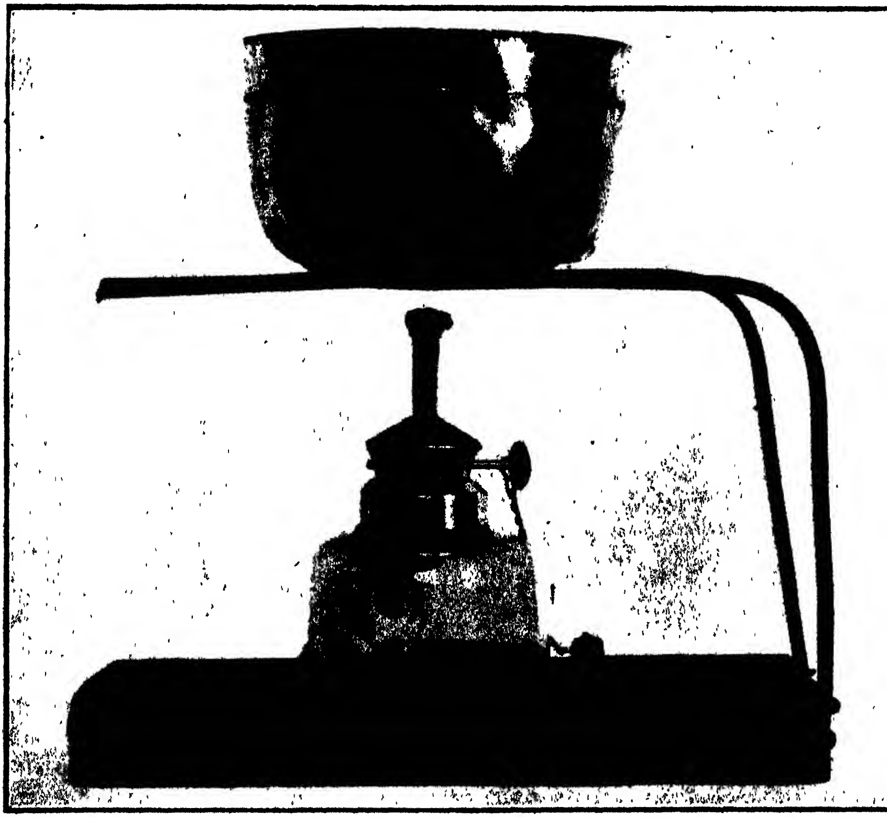

FIG. 2. SHOWING APPARATUS USED IN NICOTINE SULPHATE FUMIGATION.

The supporting stand consists of No. 8 fencing-wire bent into shape and stapled on a wooden base. [*Photo by H. Drake.*

## RECOMMENDATIONS FOR CONTROL.

Fumigation and spraying tests were conducted for determining suitable methods of control. Of the methods investigated fumigation with nicotine sulphate gave the most efficient results. Several houses have been treated under practical conditions and complete control obtained in each case.

Nicotine sulphate should be used at a dosage of 25 c.c. (28·5 c.c. approximately equal 1 fluid ounce) to each 1,000 cubic feet of house.

The cubic capacity in feet of the usual type of house with centre ridge may be calculated by multiplying the length by breadth by average height: Average height equals

$$\frac{\text{(height from ground to ridge plus height of outer wall)}}{2}$$

Suitable apparatus for volatilizing the nicotine consists of small metal containers and methylated-spirit lamps (Fig. 2). To ensure that a lethal dosage of nicotine vapour is obtained throughout the house it is advisable to have one lamp and container to each 2,000 cubic feet and to adjust the flame of the lamp so that the nicotine is volatilized in about one hour. Since few houses are gastight it is advisable to choose a calm day for the fumigation and to commence treatment towards sundown, allowing the vapour to act overnight. In the morning the house should be thoroughly ventilated.

Where the house is insufficiently gastight to allow of successful fumigation, spraying with nicotine sulphate may be adopted. For this purpose nicotine sulphate 1 pint to 100 gallons water with 2 lb. to 3 lb. soft soap should be used. Since it is almost impossible to obtain complete coverage, it is advisable to watch the plants closely for any subsequent spread of the mite and, if necessary, repeat the application.

Owing to the rapidity with which a small initial infection may become epidemic it is advisable to apply remedial treatment immediately the pest is observed.

In those cases where two tomato crops are grown each year the interval between the removal of an infested crop and the subsequent planting should be as long as possible. Care should be taken to remove all the old plants and, whilst the house is empty, to cultivate the soil thoroughly. As a precautionary measure fumigation or spraying is advisable as soon as the new crop is established.

## ACKNOWLEDGMENTS.

The authors express their thanks to Mr. W. H. Rice, of Messrs. Radley and Co., Auckland, who first drew attention to the presence of the mite; to Mr. C. P. Gibson, of the Horticultural Division, for his assistance in carrying out the survey; and to Mrs. G. B. Pettie, of Avondale, who made available a number of plants for experimental spraying and fumigation.

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TRYON, H. (1916–17): Ann. Rept. Dept. Agric. and Stock, Queensland, p. 55.
MORGAN, W. L. (1935): *Agric. Gaz., New South Wales*, Vol. 46, p. 683.

**An outstanding result from superphosphate top-dressed at 2 cwt. per acre in November on tussock hill-country near Fairlie is recorded by the Instructor in Agriculture, Timaru. An area of ½ acre, taking in both sunny and shady faces, was top-dressed and there has resulted a remarkable clover-growth, the clovers being red, white, and alsike. These clovers, save for a little stunted white, seem non-existent in the rest of the sward, which consists mainly of tussock, danthonia, catsear, brown-top, and haresfoot trefoil. No clover was sown with the superphosphate.**

# APPLICATION OF ORCHARD SPRAYS.

## IV. SPRAY COVERAGE.

G. G. TAYLOR, Plant Diseases Division, Plant Research Bureau, Department of Scientific and Industrial Research.

THE significance of spray coverage as an essential factor in successful disease and pest control became apparent in New Zealand following surveys made in Nelson during the 1932–33 season and in Hawke's Bay in 1933–34. From the records obtained it was shown that wide differences occurred from one orchard to another in the volumes of spray applied per tree, and in the nozzle pressure maintained. Thus in different orchards where trees were of similar size the volume of spray applied per tree varied from ¾ gallon to 4 gallons and nozzle pressure from 100 lb. to 500 lb. per square inch. It was apparent, therefore, that either wide differences in disease-control were being obtained or in certain instances excessive amounts of spray were being applied. Similarly, differences in pressure indicated that these were unnecessarily high in some instances, or that, in others, the low pressure maintained resulted in inefficient disease-control.

The present series of experiments were undertaken to determine the significance of spray coverage in disease-control, and to ascertain the most efficient method of obtaining maximum coverage.

### VOLUME APPLICATION.

To obtain maximum coverage it is necessary to apply more spray than is retained by the tree. Theoretically, wastage of spray could be reduced to a minimum by maintaining a low rate of delivery at the nozzles and by spending sufficient time in spraying. To be economical, however, spraying must be completed within a reasonable minimum time. With reduction in time of spraying a more than proportionate increase in volume delivery is required to assure that maximum coverage is obtained, with the result that a greater volume of spray is applied. The quantity retained by the tree, however, remains the same. Thus the volume application necessary to give maximum coverage is a variable factor dependent on the volume delivery of spray at the nozzles and on the time spent in spraying.

Experiments were carried out to determine (i) the significance of volume delivery and time of spraying on spray coverage, and (ii) the effects of variations in volume delivery on control of codling-moth, black-spot, and red-mite.

### INCREASE IN TIME OF SPRAYING AND IN VOLUME APPLICATION.

#### EXPERIMENTAL METHOD.

The trees were selected by measurement, the average height being 8 ft. 3 in., and the average span of limbs 8 ft. 6 in. Volume delivery was kept constant at 1·375 gallons—*i.e.*, 222 fluid oz.—per minute, the treatment of the different plots being varied by increasing the time spent in spraying from 20 seconds per tree to 150 seconds per tree. Thus the minimum volume application was 73 fluid oz., and the maximum

550 fluid oz. A spray of 7·5 lb. hydrated lime* in 100 gallons of water was applied with a power spray-pump at a nozzle pressure of approximately 250 lb. per square inch.

Differences in coverage were ascertained by observation and by chemical estimation† of the weight of calcium hydroxide residue on samples of leaf tissue. Samples were obtained by cutting disks of tissue from the centres of leaves by means of a 1¼ in. hollow punch. Sixty disks were taken from each tree, thirty being from the outer parts of the tree, ten from the highest parts, and twenty from the inner portions. Leaves were picked in groups of eleven, and from these the disks were punched, the lowest being discarded to avoid possible loss of spray material or contamination from the board on which they had rested.

Preliminary tests indicated that samples of sixty leaf disks per tree gave sufficiently consistent results to show significant differences beween the various treatments.

RESULTS.

Where the lowest volume of spray (73 fluid oz.) was applied, in the shortest time (20 seconds) fine droplets of spray were deposited on portion of the fruit and foliage. Some of the leaves carried a continuous film of spray, and on certain of the apples the fine droplets of spray had coalesced to form larger drops. Considerable areas of the fruit and foliage were untouched by spray. As the time of spraying and therefore the volume application were increased, the areas completely covered with spary became more extensive, the parts with a cover of fine droplets less frequent, and fewer areas remained free of spray. Where 2 gallons (320 fluid oz.) were applied the trees appeared to be saturated with spray.

Chemical analysis showed that with increase in time of spraying and in volume application the quantity of spray residue on the samples of leaf tissue increased. The rate of increase in the quantity of spray residue recovered was rapid at first, became reduced as the higher volume applications were reached, and finally, after the trees were saturated with spray, constant amounts of spray residue were recovered irrespective of the quantity of spray applied (Fig. 1).

## INCREASE IN VOLUME APPLICATION WITH CONSTANT TIME OF SPRAYING.

EXPERIMENTAL METHOD.

Trees of approximately equal size were sprayed in five plots of four trees. The time of spraying was the same for each plot, but the volume delivery was varied by altering the diameter of the disk aperture in the nozzles so that volume application was increased. Each tree was sprayed for one minute, the minimum volume application per tree being 142 fluid oz., and the maximum 480 fluid oz.—*i.e.*, 3 gallons.

In addition to the estimation of spray residue on samples of leaves, the residue on fruit was measured. For the latter purpose sixty apples were taken at random from each plot, repeated tests having shown that this number gave sufficiently consistent results.

* A high quality commercial product in which 88 per cent. of the particles were 10 microns and less.

† The majority of the analytical work recorded was carried out by the Dominion Laboratory, Department of Scientific and Industrial Research, Wellington.

In the experiment in which the spray residue on applies was measured hydrated lime was used at 6·3 lb. per 100 gallons of water. The average height of the trees was 8 ft. 6 in. and the average span of

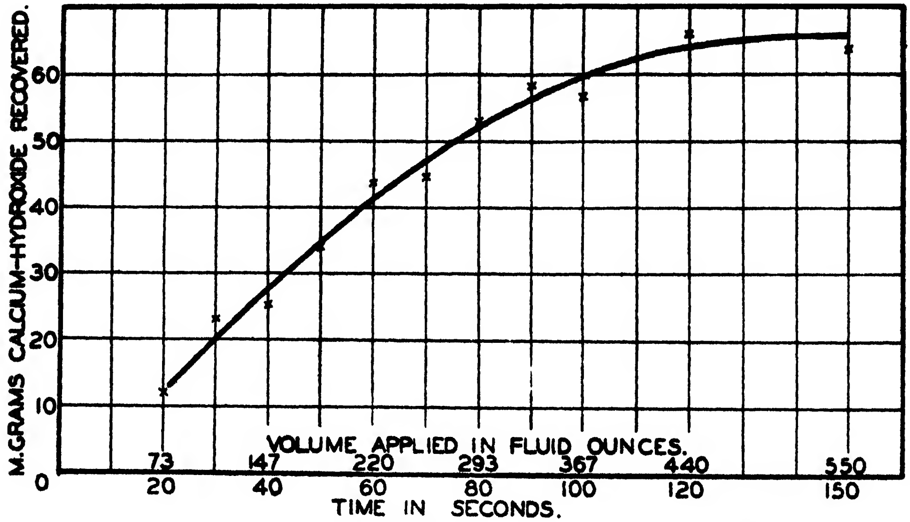


FIG. 1. EFFECT OF INCREASE IN TIME OF SPRAYING AND IN VOLUME APPLIED ON THE AMOUNT OF SPRAY RESIDUE ON LEAF-SAMPLES.

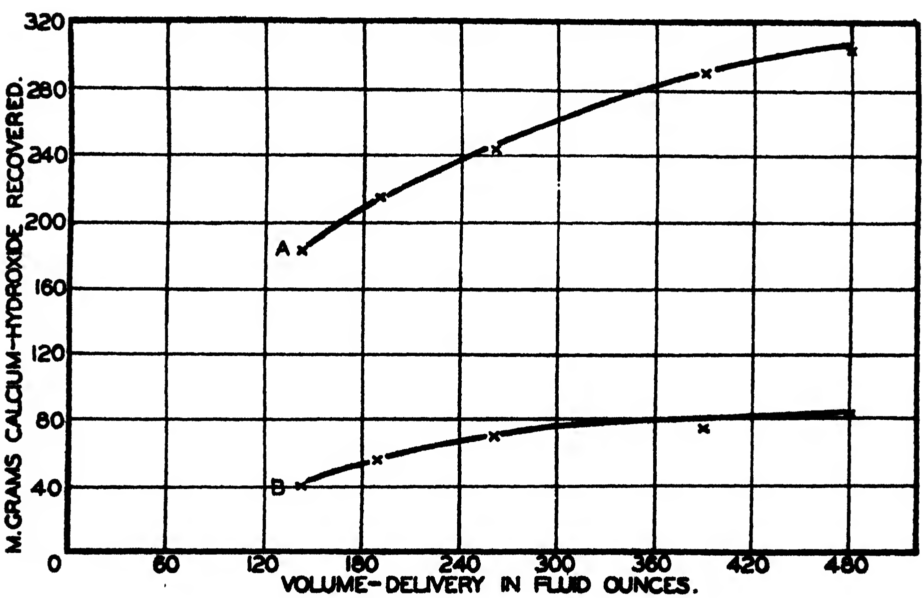


FIG. 2. EFFECT OF INCREASE IN VOLUME DELIVERY ON THE AMOUNT OF SPRAY RESIDUE ON (A) FRUIT-SAMPLES AND (B) LEAF-SAMPLES.

limbs 8 ft. 8 in. Where leaf-samples were taken lime was used at 7·5 lb. per 100 gallons of water, the average height of the trees was 7 ft. 4 in., and the average span of limbs 8 ft. 9 in.

Other details of the experimental method were similar to those described above.

RESULTS.

Increase in volume delivery increased the amounts of spray residue remaining on the fruit and foliage (Fig. 2). Study of the plots indicated that the increase in spray residue was due mainly to the spray contacting with areas previously unsprayed, and, where the fruit was concerned, to the finer droplets of spray coalescing to form comparatively large droplets.

## Increase in Time of Spraying with Constant Volume Application.

EXPERIMENTAL METHOD.

Methods similar to those described for the previous experiment were used. The time of spraying was varied for each plot. By adjusting the size of the disk aperture in the nozzles, volume

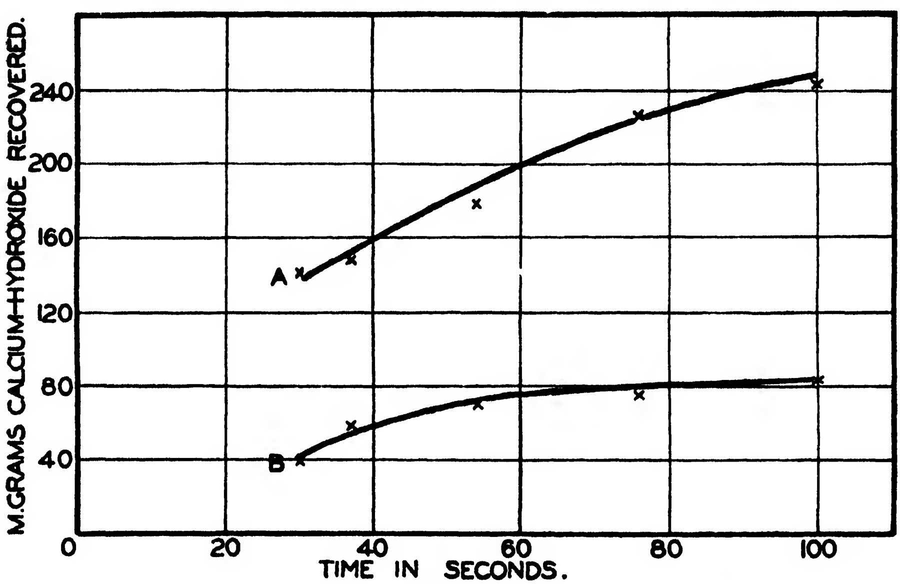


FIG. 3. EFFECT OF INCREASE IN THE TIME OF SPRAYING ON THE AMOUNT OF SPRAY RESIDUE ON (A) LEAF-SAMPLES AND (B) FRUIT-SAMPLES.

delivery was varied inversely with the time of spraying so that each tree received the same volume of spray. The minimum spraying-time per tree was 30 seconds and the maximum 100 seconds, the volume application being 240 fluid oz. (1·5 gallon) in each case.

The hydrated lime was used at approximately 6 lb. per 100 gallons of water where leaf-samples were taken and at 6·25 lb. per 100 gallons of water in the experiment in which the residue on apples was estimated. In the former experiment the average height of the trees was 7 ft. 10 in. and the average span of limbs 8 ft. 11 in., while in the latter experiment these measurements were 9 ft. 3 in. and 9 ft. 9 in. respectively.

RESULTS.

As the time spent in spraying was increased, the amounts of spray residue recovered from samples of leaves and fruit increased (Fig. 3). Where spraying was rapid it was observed that certain areas were left

unsprayed. With increase in spraying-time greater opportunity occurred for directing the spray over all parts of the tree, with the result that better coverage was obtained.

## VARIATION IN VOLUME DELIVERY AS AFFECTING CODLING-MOTH CONTROL.

### EXPERIMENTAL METHOD.

Forty large Ballarat trees, approximately 18 ft. in height were sprayed in ten plots of four trees per plot. The volume of spray applied to the trees of each plot was varied by adjustment of the volume delivered at the nozzles, the minimum volume being 0·8 gallons per minute, and the maximum 4·7 gallons. Nozzle pressure varied from 275 lb. to 300 lb. per square inch.

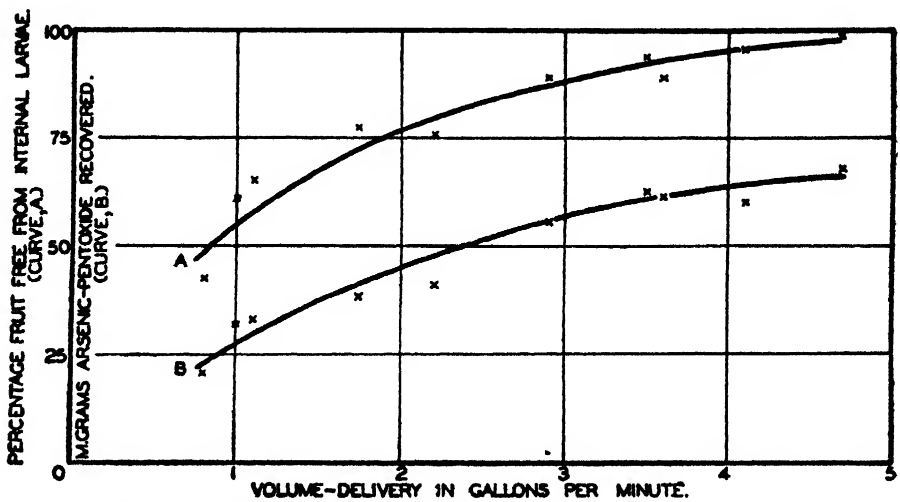


FIG. 4. EFFECT OF INCREASE IN VOLUME DELIVERY OF (A) CODLING-MOTH CONTROL AND (B) ON THE AMOUNT OF SPRAY RESIDUE ON LEAF-SAMPLES.

Owing to differences in tree size, a standard time for spraying each tree was not adopted. However, a constant speed of working was maintained so that the time spent in spraying varied directly with tree size.

Lead arsenate, 1½ lb. per 100 gallons of water, was applied at intervals of eighteen to twenty days from the 30th October to the 6th February.

Both windfalls and the picked crop were recorded, the fruit being divided into (i) clean or superficial damage only, and (ii) internal codling larvæ.

In order to correlate measurements of codling-grub damage with variations in spray residue, leaf-samples were taken as in the previous experiments, and the amounts of arsenate residue measured by chemical analysis.

### RESULTS.

As volume delivery was increased from 0·8 gallons to 4·7 gallons per minute, increased control of codling-moth was obtained, the percentage of apples free from larvæ increasing from 43 to 99 (Fig. 4, curve A).

Chemical analysis showed that spray residue increased as volume delivery increased, with a close correlation between increase in spray residue and codling-moth control (Fig. 4, curve B).

## VARIATIONS IN VOLUME DELIVERY AS AFFECTING BLACK-SPOT CONTROL.

### EXPERIMENTAL METHOD.

Twenty medium-sized Sturmer trees, approximately 11 ft. in height and 12 ft. in span of limbs, were sprayed in five plots of four trees each. Volume delivery was varied from 1 to 3·5 gallons per minute. Similar speeds of working were maintained as in the previous experiment. The nozzle pressure varied from 250 to 300 lb. per square inch.

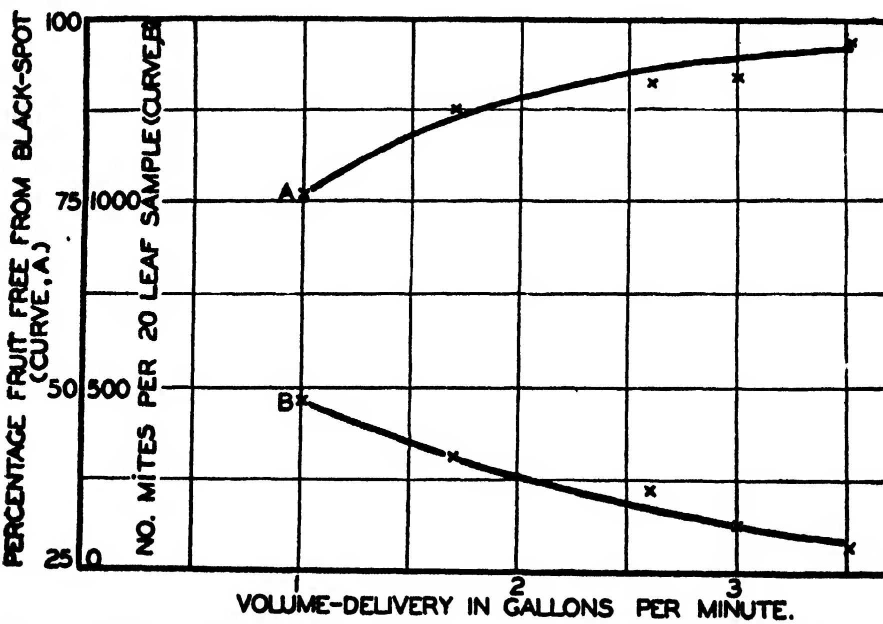


FIG. 5. EFFECT OF INCREASE IN VOLUME DELIVERY ON (A) BLACK-SPOT AND (B) RED-MITE CONTROL.

The spray-mixture consisted of lime-sulphur 0·1 per cent. polysulphide content and colloidal sulphur paste (50 per cent. sulphur by weight) 2 lb. per 100 gallons. The mixture was applied at eighteen- to twenty-day intervals from 2nd November to the 14th February, foundation sprays being the same for all plots.

Thinnings, windfalls, and picked crop were sorted into two groups consisting of (i) clean fruit and (ii) fruit showing one or more black-spot lesions.

### RESULTS.

Increase in volume delivery from 1 to 3·5 gallons per minute resulted in increased black-spot control. Improvement in control was greatest as volume delivery was increased from 1 to 2·5 gallons per minute, and became less marked beyond this point (Fig. 5, curve A).

## Variation in Volume Delivery as affecting Red-mite Control.

### EXPERIMENTAL METHOD.

The block of trees used was the same as that of the previous experiment, and the general procedure, including variations in volume delivery, identical. To determine approximately the degree of infestation, the numbers of mites on twenty leaves taken at random from each plot were counted before the oil-spray was applied. For the control of red-mite a summer-oil (approximately 85 per cent. oil) at 1 part in 100 parts of water was applied on the 19th January. Records of the numbers of mites remaining alive were taken on 23rd January. Differences between the various plots were determined by counting the number of mites on twenty leaves taken at random from each tree. Duplicate counts on individual trees showed that although the number of mites per twenty-leaf sample varied, the differences were insufficient to affect the significance of the results.

### RESULTS.

Prior to the application of the oil-sprays the number of mites per twenty-leaf sample varied from approximately 4,000 where the volume delivery of the previous sprays had been lowest—*i.e.*, 1 gallon per minute—to approximately 2,000 where volume delivery had been highest—*i.e.*, 3·5 gallons per minute.

The numbers of mites on each twenty-leaf sample remaining alive after the application of oil-sprays varied from 460 where volume delivery was lowest to fifty where volume delivery was highest, showing that increased control was obtained as volume delivery was increased (Fig. 5, curve B).

## Discussion.

The experiments show that spray coverage and disease-control are markedly influenced by volume application. When considered in conjunction with the variations in volume delivery known to occur in orchard practice, it would appear that in many instances incomplete spray coverage is obtained. Field observations bear out this conclusion, for where successful disease-control is not obtained with the standard spray programmes* it is usually found that the volume application of spray is insufficient.

Variation in the two factors which determine volume application—time of spraying and volume delivery—both affect spray coverage. The time spent in spraying is a variable factor in practice, being influenced mainly by tree size and to a lesser extent by the standards set by different men when spraying. Efficient disease-control, however, is largely dependent on the rapidity with which a coverage of spray can be obtained over the whole orchard at critical seasons. For practical purposes the time spent in spraying may be therefore defined as the maximum working-speed. Under these conditions volume delivery becomes the significant factor determining volume application. These

* See "Control of Orchard Diseases and Pests by Spraying," *N.Z. Dept. Agric. Bulletin 61.*

experiments indicate that for general orchard-spraying the optimum volume delivery is from 3 to 3·5 gallons per minute. For large trees a volume delivery of from 4 to 4·5 gallons per minute could be used with advantage.

### NOZZLE CONSTRUCTION AND NOZZLE PRESSURE.

The application of a sufficient quantity of spray is not alone sufficient to assure maximum coverage unless the construction of the nozzle and the nozzle pressure are such that the spray is distributed over a wide area. The significant factors in this respect have been discussed previously when dealing with spray nozzles. (See this *Journal*, Vol. 53, p. 68; Vol. 54, p. 71, p. 267).

Ideal coverage is obtained when the spray is deposited as fine droplets so close together as to leave a continuous cover of spray residue. It has been shown, however, that such a cover is impracticable, since the volume of spray required to saturate the trees is such that the droplets of spray coalesce and run-off occurs. The coverage secured after run-off has occurred varies from comparatively large isolated drops of spray to an almost complete cover of fine droplets, depending on the nature of the surface sprayed and on the conditions under which the spray is applied.*

Experiments were carried out to determine the significance (1) of variations in the conditions under which spray is applied, such as the fineness of the spray-droplets formed by the nozzles, depth of penetration, &c., and (2) of variation in the nature of the surface sprayed.

### EXPERIMENTAL METHODS.

Apples of approximately equal size were removed from the trees and arranged in rows of nine with the stems uppermost. Each group was sprayed until considerable run-off occurred, and, after reversing the stand, the opposite of the apples treated in the same manner. Treatment of different groups was varied—(1) By adjusting nozzle pressure from 100 lb. to 300 lb. per square inch; (2) by whorl-plate adjustment to vary the fineness of spray-droplets and the depth of penetration; (3) by adjustment in the distance of the nozzle from the fruit. Each experiment was carried out in triplicate. The spray was composed of 4 lb. lead-arsenate in 100 gallons of water.

Differences in cover effected by the various treatments were ascertained by observation, and in some instances by chemical analysis of spray residue. It was found that spray tended to collect to a varying extent in the depression surrounding the stem, and, since this did not represent normal coverage, the stem and portion of the skin was removed from each apple before the quantity of spray residue was estimated. The fruit was thoroughly washed before treatment, and unsprayed samples included for analysis with each experiment.

† The types of cover discussed in the present paper are those formed in the absence of commercial wetters or spreaders.

In order to determine the influence of variation in the nature of the surface sprayed, mature plums and peaches were included in the different treatments.

## RESULTS OF EXPERIMENTS WITH APPLES.

(1) *Nozzle pressure.*—Increase in nozzle pressure from 100 lb. to 300 lb. improved the distribution of spray on the fruit, the size of the droplets of spray being reduced but the number considerably increased. When the nozzle was held at a distance of 2 ft. from the apples it was found that draught from high pressure tended to remove the droplets of spray from the sides of the apples farthest from the nozzle. This effect was reflected in the measurements of spray residue, which showed an average per group of apples of 3·3 mg. arsenic-trioxide at 100 lb. pressure and 3·1 mg. at 300 lb. pressure. With increase in the distance between the nozzle and fruit the blowing effect of high pressure was reduced, an experiment with the nozzle 4 ft. from the fruit showing an increase in spray from 3·65 mg. at 100 lb. pressure to 4·7 mg. at 300 lb. pressure.

(2) *Whorl-plate Adjustment.*—Adjustment in the whorl-plate so that the spray formed was varied from relatively coarse droplets with high penetration to fine droplets with inferior penetration resulted in improved coverage, the difference being apparent in a reduction in the size and increase in the number of spray-droplets remaining on the fruit. The average amount of arsenic-trioxide recovered from the group of apples was increased from 3·7 mg. where the spray applied was of relatively coarse droplets with high penetration to 3·5 mg. where the penetration was lower and the droplets of spray finer.

(3) *Distance of Nozzle from the Fruit.*—Increase in the distance of the nozzle from the fruit up to 8 ft. resulted in improved coverage. At the greater distances certain of the droplets of spray remaining on the fruit became comparatively large in size before run-off occurred, whilst in the intervening spaces fine droplets of spray remained to form an almost complete cover. Estimation of spray residue showed that the average amounts recovered per group of apples increased from 3·1 mg. when spraying at 2 ft. to 4·7 mg. at 8 ft.

## RESULTS OF EXPERIMENTS WITH PLUMS.

Differences in spray coverage resulting from the various treatments were similar to those obtained on apples. In each treatment, however, the coverage obtained on plums was inferior to that on apples.

## RESULTS OF EXPERIMENTS ON PEACHES.

In these experiments two distinct types of cover were obtained—(1) That in which the spray remained as drops resting on the hairs covering the fruit; and (2) that in which the spray penetrated between the hairs and formed a continuous film.

The former type of coverage was obtained where a spray of fine droplets with poor penetrating-power was used.

Increase in pressure, adjustment in the whorl-plate to produce a more driving spray, and reduction in the distance between the nozzle and fruit all assisted towards obtaining the latter type of coverage.

## DISCUSSION.

It is apparent that spray coverage is largely influenced by the conditions under which the spray is applied and by the nature of the surface sprayed. Variation occurs not only in the distribution of the spray, but in the total quantity of residue remaining on any given area.

On surfaces which are rough—*e.g.*, bark, pear fruits of certain varieties, &c.—it is relatively easy to obtain a continuous cover of spray.

Where the surface sprayed is smooth—*e.g.*, most apple fruits—the spray remains on the fruit as isolated drops, relatively large in size, with the adjacent spaces filled to a varying extent with finer droplets. It was not found possible to obtain a continuous cover of spray on a smooth surface other than by the aid of wetting or spreading agents. Improvement in cover is obtained by the use of a nozzle (or combination of nozzles) forming fine droplets of spray and by applying the spray under high pressure (250 lb. to 300 lb.) with the nozzle held sufficiently distant from the fruit to avoid removal of spray by the blowing effect of high pressure.

" Waxy " surfaces such as the surface of most plum fruits are difficult to cover effectively. The best results are obtained under conditions similar to those applying to " smooth " surfaces, but even under the most favourable circumstances the coverage is often poor, the drops of spray being isolated with comparatively large areas apparently free of spray.

The " hairy " type of surface, represented by peach fruits, can be covered with a continuous film provided the spray is applied with sufficient force to penetrate between and wet the hairs. For this purpose a nozzle giving a relatively coarse spray with high penetration is required. Maximum nozzle pressure should be maintained and the spray applied with the nozzle held as close as possible to the fruit.

## METHOD OF APPLICATION.

The attainment of maximum coverage is largely dependent on the personal efficiency of the operator. As a rule the more exposed parts of the tree are rarely missed, and in order to assure that those parts which can be less easily seen are covered it is essential that the spray be applied systematically and from as many directions as possible.

The most satisfactory results are obtained by completing each tree before commencing the next. In some instances, however, the method adopted is to work along a row of trees, spraying half of each tree, and to complete the spraying from the other side of the row. The latter appears to reduce the amount of walking required, but unless carefully carried out may result in parts of the tree being left unsprayed.

The structure of the trees as influenced by pruning methods is of considerable importance in determining the efficiency of application. The main points of significance in this respect are that the centres of the trees should be kept open, the presence of duplicate leaders avoided, and the laterals well spaced. Early thinnings of the bunches so that not more than two fruits are left together assists in obtaining maximum coverage.

# CARE IN DRENCHING SHEEP.

By L. W. N. FITCH, Veterinary Laboratory, Department of Agriculture, Wallaceville.

DURING the past months there have come to our notice several cases of abscess formation in the lower jaws of sheep. In many cases a fair number of sheep have been affected in a single flock, and the trouble has caused much consternation in some cases where valuable sheep were involved, as the condition is not infrequently followed by death.

These outbreaks have not been confined to any single area, and it has been found that they are in all cases preceded by the use of an automatic drenching-gun. These guns have in some cases a very rough nozzle (due to being bitten on by sheep) and this, in some cases, in combination with incorrect drenching technique, has been responsible for damage to the delicate lining membrane of sheep's mouths. In addition, a certain amount of the drenching-fluid may be forced into the tissues causing still further damage.

In addition to the damage as described above, and still more important, is the fact that the mouth is teaming with bacteria which gain access to the deeper tissues through the abraded surface and multiply there, with the result that abscesses are formed. These abscesses vary considerably in character. Some are very acute and may cause the death of the animal from toxæmia within a few days. These may never burst to the exterior but burrow their way through the tissues, which are destroyed by toxins. One such case seen at the laboratory had actually spread to the jugular vein, the wall of which had given way, with the result that the sheep bled to death. Others may be less acute and may burst under the jaw, when the prospects of healing are much better, of course. Still others may never burst, but, after say ten to twelve days, may be felt as a hard, firm swelling of inspissated pus, which will gradually be absorbed.

The contents of these abscesses varies from a dirty, brownish, watery mixture to a thick, creamy pus, depending on the nature of the infection.

## TREATMENT.

The rational treatment is, of course, prevention. This is achieved by careful and correct drenching technique and by taking care that the drenching-gun nozzle is not rough. A picture is appended showing the correct way to drench sheep. The method is as follows :—

The sheep are in a crush or small pen, and the operator stands alongside or astride the sheep. The sheep is allowed to stand as naturally as possible, as excessive restraint only makes the animals struggle. The sheep should not be up-ended on to its rump. The operator holds the sheep with his left hand, the lower jaw being held with the thumb in the interdental space—*i.e.*, between the front and back teeth. The gun is now put into the sheep's mouth from the side, the nozzle run backwards towards the base of the tongue, and the dose delivered At the time of delivery of the dose the end of the nozzle should rest on the base of the tongue and be directed backwards, and not sideways, at an angle to the jaw. If this is not done part of the dose may be lost, and further, damage may be done the gums.

If these simple directions are observed, there should be no damage to the mouth, with a consequent absence of maxillary abscesses. Further, the chances of pneumonia resulting are reduced to a minimum. Curative treatment is of limited value, and consists chiefly in providing good drainage to the abscess by opening at the correct stage, and irrigation with disinfectants. A further aid to prevention may be the addition of a piece of rubber tubing to protect the nozzle.

CORRECT METHOD OF DRENCHING SHEEP.

One must distinguish the above-described condition from another type of abscess sometimes seen in the lower jaws of sheep. These are usually further forward in the jaw and run a longer course. They are due to the penetration of grass-seeds between the teeth and gums, or, in some cases, through the covering skin. The bone itself is often affected in these cases, and the jaw may be greatly deformed. Such cases frequently result in death.

The Fields Instructor, Masterton, reports that a farmer in the Akitio district has been top-dressing his hill-country with super for the past six seasons, doing approximately one-third of the farm annually, and has just completed twice around the property. Previous to top-dressing his carrying-capacity was 1,000 ewes and 1,000 dry sheep, very little going off the place fat. To-day he carries 2,000 ewes (about half to Southdown rams) and 200 dry sheep, all surplus going away fat.

# COMB HONEY.

## ITS PRODUCTION AND MARKETING.

H. F. DODSON, Apiary Instructor, Palmerston North.

THE production of comb honey is generally regarded by beekeepers with disfavour or indifference. This is associated with production and distribution problems. Two smaller problems are the reluctance of bees to undertake this particular form of storage and the lack of skill on the part of the apiarist to deal with the bees' reluctance. For these latter reasons, many amateur beekeepers eschew comb-honey production. The indifference of the commercial man, however, lies in the former and less easily surmounted obstacle—distribution.

The commercial apiarist realizes the difficulty—almost the impossibility—of selling large quantities of comb honey in sections—and present-day prices demand a large turnover in any form of honey. He also knows that sections require very careful handling and packing. If one breaks, it is usually in the top row that this occurs, and it then weeps honey all over the cappings of the undamaged sections below.

The main problem of production is the weather. A rapid and constant flow is very necessary for raising first-class sections. It is true, however, that a good average season for extracted honey will usually yield a good average crop of comb honey, provided the hives are in a fit and proper condition.

There is a potential market for comb honey in New Zealand. A large section of the community prefers honey in this form and some will take no other kind of honey. But haphazard methods will bring no results.

Honey in the comb is regarded by many people as being honey in its most natural condition. Without any doubt it is the most natural form of honey. The extracting and tinning of honey is a comparatively modern process, and one that has been evolved to meet a larger need—an ever-growing demand for honey in a cheap and serviceable form. The mass production of honey is filling that need.

But honey in the comb remains the unchallenged choice of the epicure; and, no matter how fine the grain and flavour, nor how beautifully designed the tin and its label, extracted honey can never enter the same class as comb honey. Honey that has been stored by the bees and sealed at exactly the right moment, honey that has been in contact with nothing but the flowers of its origin and the bees who gathered it as nectar, storing and sealing it in the waxen cells of their own manufacture—such honey bears its own seal of purity.

The fundamental difference between the raising of sections and the production of extracted honey is that, whereas the bees like straight comb, they intensely dislike sections. In drawing out full sheets of foundation, the bees are able to cluster to their hearts' content. The drawing-out of sections, however, involves the breaking-up of the cluster into smaller ones, only a few inches square. The bees' dislike to this arrangement is a perfectly reasonable one, because the secretion of wax by their wax glands depends on the heat they are able to generate. The bigger the cluster, the greater the heat.

The key to the whole business so far as the apiarist is concerned lies in that one central fact—the bees must be induced to want to cluster on the sections. If the bees' problem is that the breaking-up of their cluster reduces the heat, then the apiarist must see to it that there are sufficient numbers of bees in the hive to build up a solid wall of reserves behind these divided clusters for relieving them and for maintaining the temperature in the super. At the same time it is also important to see that the hive is well above the ground, allowing a plentiful supply of fresh air to circulate. Heat in this case must not be confused with stuffiness, which will cause swarming more quickly than anything.

Hives that are to yield a good crop of first-class sections must be strong colonies with a large force of young bees as well as a good foraging force. The first step, then, is to build up a powerful colony from a young and vigorous queen that will keep the hive well stocked. Assuming the colony to have been wintered in one box, it should be built up during the spring into two boxes full of brood and bubbling over with bees. All emerging brood and the queen should be kept in the bottom box, only eggs and very young larvæ being allowed in the second box ; the two outside combs may be empty. Any emerging brood over the ten frames should be given to other hives requiring them. As the bees hatch out, the queen has room to lay, and the bees have the two outside frames in the second box in which to store any honey that may come in.

In districts where there is an early flow of dark honey, it is very sound to add a super as soon as the flow starts. This may be judged by the whitening of the tops of the combs. The bees take possession of a super of drawn comb very readily as honey starts to come in, and a super of dark honey makes excellent feed and develops in the bees the idea of storing upstairs. The brood manipulation already referred to keeps the queen below, and as the flow develops into a better quality the hive is approaching a condition where good habits are being practised.

The next step is concerned with creating a desire in the bees to draw out the sections. There are many and varied plans for doing this. The late Dr. C. C. Miller, one of the most successful producers of comb honey, used what he termed " go-back " sections to act as baits. That is to say, he used to put unfinished sections from the previous year in with the undrawn sections to tempt the bees into the super. For those intending to take up section-raising Dr. Miller's book " Fifty Years among the Bees " can scarcely be equalled.

Jay Smith, an eminent American beekeeper, uses a system of raising sections and extracting combs in the same box. This is an excellent plan, and should commend itself to New Zealand beekeepers where the vagaries of the weather are so pronounced.

An ordinary section super holds seven frames. One of these should be removed ; on each outside an extracting-frame containing fully drawn, empty comb should be placed. This super is then ready to be added. Immediately this is given to the bees that are crowded for space they start to store in the two outside combs. They are thereby instantly attracted to the fresh story : they start to occupy it at once and to work in it at once. As the season opens up they fill and seal the outside frames, and, working on to the section frame next to it,

gradually extend towards the centre. Of the numerous methods used and advocated, this is the simplest and appears to bring the best results.

As soon as it is filled, the super of early honey can be taken off and replaced with the prepared super of sections. If a half super is used, the clusters that were working on the super just removed are forced into half the space. This is advantageous, as it gives that extra concentration so necessary for sections. Another advantage is that a half super takes only half the time to complete. This means that the sections are on the hive only half the time, and in consequence do not become so travel-stained.

The machinery of distribution cannot be dealt with adequately in this article, but the following outline of possible action is designed to give some guidance.

The first thing to realize is that people do want comb honey, and if people want a thing they are usually prepared to pay for it.

If people want to buy something, a merchant is immediately interested, but he has to be satisfied that they really do want to buy and will keep on buying.

The beekeepers have their own commercial organization which exists for the purpose of distributing honey to people that want it. But before such an organization can be utilized, the producers have to show conclusively first that they can and will produce, and, secondly, that, having produced, there will be no difficulty in disposal.

The first step in this direction is co-operation. The beekeepers in a given area should combine and produce comb honey, packed in cellophane with a cardboard container, and standardize their quality and price. The commodity must be standard, of high quality, and an attractive pack. A distributing organization would willingly handle such a commodity.

In favour of extracted honey we have an additional tonnage and the retaining of the comb and the cappings. The amount of labour involved is, contrary to the general notion, about equal, unless the producer exports all his honey in 60 lb. tins, in which case labour is a larger cost in the case of sections.

It is difficult to determine accurately what crop of sections in ratio to a crop of extracted honey may be taken in any given season. The ratio alters according to the length and quality of the flow. In a first-class season the crop of sections would be much nearer the extracted crop; in a poor season, yielding no sections, a fair crop of extracted honey might be gathered. The capital outlay required for running a few hives for comb honey is far less than that required for equipping an extracting house.

Finally, as the production of comb honey is still in its infancy, a word of caution seems warranted. It would not be wise for any one at this juncture to produce comb honey too extensively. The purpose of this article is to demonstrate that comb honey can be successfully produced under normal conditions, and that there is a potential market capable of absorbing large quantities. The apiarist who desires to pioneer this comparatively unexplored branch of the honey industry must be prepared to build up from small beginnings, either by himself or in conjunction with other apiarists, the production of a first-class commodity and a collateral suitable marketing organization.

# SEED-WHEAT CERTIFICATION.

THE following is a list of growers for the month of May whose wheat crops have passed both the field and grain inspections required under the Government scheme for the certification of seed wheat. The seed from these crops is not recognized as finally certified until it has been satisfactorily machine-dressed and the sacks suitably sealed and tagged. (Previous lists, to which those interested are referred, appeared in the March, April, May, and June *Journals*) :—

| Variety. | Grower. | Acreage. |
|---|---|---|
| Cross 7 .. .. | Brophy, K. .. .. .. .. | 13 |
| | Forster, J., Washdyke .. .. | 6 |
| | Henderson, W. L., Teschemakers, Waimate, R M.D. | 15 |
| | Kean, C. A , Limehills .. .. | 3 |
| | Pemberton, S., Winchester .. .. | 30 |
| | Talbot, C. J. and G. W., Fairlie .. | 19 |
| | Talbot, P R , Claremont, Timaru (Line A) | 30 |
| | Watson, D. M., Methven .. .. | 11 |
| Dreadnought .. | Medlicott, F S , Hook .. .. | 10 |
| | O'Sullivan, E. D., Park Road, Albury .. | 16 |
| | Ruddenklau, H , Estate of, Waimate .. | 20 |
| Hunters II .. | Ford, W., Eiffelton, R.M.D. .. .. | 11 |
| | Horsnell, H. S., Morven .. .. | 8 |
| | Hunter-Weston, R. P., Albury .. | 9 |
| | Miller, P H., Fairlie .. .. .. | 10 |
| | Ruddenklau, H , Estate of, Waimate .. | 32 |
| Solid Straw Tuscan | Brunton, D., Otaio .. .. .. | 30 |
| | Darling, S , Seadown .. .. .. | 6 |
| | Dickson, A. M., St Andrews .. .. | 8 |
| | Gosling, A , Claremont, Timaru .. | 10 |
| | Henderson, W. L., Teschemakers, Waimate, R.M D. | 15 |
| | Lynskey, M., School Road, Yaldhurst .. | 14 |
| | Lysaght, T., Tripp Settlement, Geraldine (Line B) | 10 |
| | Medlicott, F S., Hook .. .. | 12 |
| | Ross, C. E., Laghmor, Ashburton .. | 20 |
| | Tozer, W. J, Rangitira Valley, Temuka .. | 12 |
| | Waller, G., Tripp Settlement, Geraldine (Line B) | 7 |

—*Fields Division.*

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The Sixth Conference of the New Zealand Grassland Association will be held in Dunedin on August, 10th, 11th, and 12th. Non-members as well as members are invited to attend. The subscription of membership is 5s. per annum.

*Use of Cow-shed Wastage.*—The matter of utilizing droppings and washings from sheds and yards is receiving considerable attention: already fifteen plants are all working satisfactorily, and good results are being secured from the operation. An estimated cost of the outlay is as follows: Sump, 500-gallon capacity, cement-lined, own labour, £7; hand pump, 6 ft. lifts 1½ gallons per stroke, £4 17s. 6d.; tank, painted, £6; sledge, complete with fittings, £10 10s. (drawn by one horse, or two in wet weather: total, £29 (approximately). One farmer with a 110-cow herd in one shed runs the washings straight into his tank and spreads them every day; but most men provide a sump of 500 to 2,000 gallon capacity and top-dress when convenient. Odd cases of trouble over grit carried in on the hoofs of animals affecting pump-washers are reported; but one man has installed a diaphragm pump costing £15, which is doing good work.—*Instructor in Agriculture New Plymouth.*

# SEASONAL NOTES.

## THE FARM.

### Bearing of Pig-keeping Position on Cropping Programme.

For the present at least the United Kingdom is practically the only export market for New Zealand pig products. The present position has not changed materially from what it was in 1936, when the United Kingdom imported 363,124 tons of bacon and hams, 5,800 tons of fresh pork, and 51,400 of chilled or frozen pork, a total of 419,524 tons of pig products ; in the same year the imports of frozen lamb and mutton totalled 315,626 tons.

The 51,400 tons of frozen or chilled pork imported in 1936 included 29,028 tons imported from New Zealand, this being 56 per cent. of the total.

When the quantitative relationship between the pork and the bacon imports of the United Kingdom is taken into consideration, it becomes clear that any substantial increase in the number of carcasses of porker weights exported would involve a distinct danger of over-supplying the market with the usual influence of this upon prices.

In the face of this position greatly increased output of pig products for export by New Zealand is considered both easily possible and highly desirable, but as a glutted market is invariably unsatisfactory to the producer the increased production of pig products to be of the fullest economic value clearly must be correlated with the production of a greater proportion of carcasses of baconer-weight, and the proportion of such carcasses must become progressively greater as our exports grow. In view of the market position it is gratifying that there already is a distinct trend to an increased proportion of carcasses of baconer-weight and slaughterings for export: in 1932–33 there were 53,608 bacon carcasses in a total of 310,389 carcasses, while in 1935–36 the corresponding figures were 219,690 and 679,561 while the position is still better in the elapsed portion of the current producing-year, the figures for eight months to the end of May being 239,162 baconers in a total of 642,669 carcasses.

Practices already being carried out with economic results by certain farmers, if adopted more generally, will enable the present desirable trend in the porker-baconer ratio of production to be intensified when and as this is necessitated by further growth in our pig industry. An important one of these changes is the wintering of store pigs. A report of an investigation by the Manawatu–Oroua Pig Recording and Development Club relative to the wintering of pigs was published in this *Journal* in January last. The investigation covered a period of sixty days in May to July : the initial live-weight of the pigs was approximately 70 lb. (other experience suggests that much smaller pigs would not fare so well), and the pigs made an average daily gain of ⅓ lb. a pig. The feeding-stuffs used were barley, peas, mangels, pumpkins, and meat-meal. In assessing the feeding-cost of wintering, barley, peas, and meat-meal were charged at 1d. per pound, and roots were charged at 12s. 6d. a ton. The cost of the feed on this basis was 8s. 9d. a pig. The commercial difference in price between a 70 lb. pig in the autumn and the same pig in the spring having grown in the meantime at the rate of ⅓ lb. daily is always much greater than the sum of 8s. 9d. One point of great practical importance is that pigs wintered in the way described are available to consume very effectively the dairy by-products in the spring and develop to bacon weights relatively early in the new producing-season.

Further, by wintering pigs in this way the farmer often can solve the problem, which otherwise may be difficult, of how to handle satisfactorily second litters within the one year: the proper wintering of pigs mainly on home-grown feeding stuffs is likely to be much preferable either to selling them as somewhat small porkers or as stores at "sacrifice" prices. The rations used in the investigation were—(1) Barley, meat-meal, and pumpkins; (2) barley, peas, and pumpkins; (3) barley, meat-meal, and mangels; (4) barley, peas, and mangels. The principal results are in complete conformity with a considerable amount of practical experience.

### Special Crops for Wintering of Pigs.

From the results of the investigation and of considerable supporting practical experience it may be deduced that when the yields of mangels, pumpkins, peas, and barley are tolerably good following a reasonable standard of efficiency in their culture, then these crops may profitably be grown for use in the winter feeding of pigs. Outside the milder northern districts the yields of pumpkins seem as a rule to be too low to justify using the pumpkin in place of the mangel. The mangel may at times not be mature early enough to be fed with safety to pigs when the feeding of roots first becomes desirable. To provide for such a possibility such crops as swedes, chou moellier, and carrots may be grown for use before the mangels have ripened, and in conditions well suited to good yields from these three crops they may quite well be used to displace the mangels largely or even completely.

It is not always realized that home-grown peas and barley can be used very efficiently in pig-keeping without the necessity for outlay on special machinery, such as a binder, which is not part of the regular equipment of dairy-farms, and without the bother and expense of threshing such crops. In actual practice these crops are being harvested quite well by mowing, and pigs being excellent gleaners no wastage of consequence occurs when they are given unthreshed peas or barley.

In the warmer districts, where reasonably good yields from barley and peas cannot be depended upon, experience has indicated that maize grain may be used with great success in the wintering of pigs. Full information about the crops that suitably may be grown in specific districts for the wintering of pigs and about the culture and use of such crops may be obtained from local officers of the Fields Division.

In planning the wintering of pigs it should not be overlooked that pastures and kindred crops such as green leafy cereals have frequently been employed with success to contribute a substantial portion of the ration of pigs. Further, success from pastures and kindred crops used in this way cannot be expected unless the crops are at a leafy as distinct from a stemmy stage of growth and unless they are available in adequate amounts. Pigs may be grazing on leafy pastures which are grazed so closely that the pastures actually contribute very little to the daily ration, and in such circumstances poor results may be expected.

### Breaking-up of Pastures.

A most important question that arises at this stage in the year's work is the acreage and location of the grassland it is advisable to put under the plough during the coming season. One of the main matters that should be given consideration in deciding the answer to this question is what area of special crops—such as mangels, swedes, turnips, chou moellier, carrots, and cereals—it is desirable to grow to ensure adequate supplies of feed when that available directly from grassland is likely to be below the requirements of stock during the critical periods in late summer and in winter and early spring. This should be considered in conjunction with the area it is proposed to utilize for hay and silage. Of considerable practical importance in connection with the provision of special feed is the fact that generally the

provision made for the critical seasons is less than is required for full economic feeding of stock, and that, especially in dairying, but also in sheep-farming, there often would be more profitable results were the plough used more freely as a step towards better feeding during those periods when the feed from pastures usually is too scant.

Another important matter sometimes ignored is that breaking-up of pastures may be the most economic course to adopt when the improvement of inferior swards is sought. This matter was dealt with at some length in these notes last month.

### Pastures Inferior to Their Natural Conditions.

Quite frequently pastures are of lower production than is warranted by the natural conditions under which they are growing. Expressed otherwise, often the land is capable without the aid of such practices as top-dressing or draining of supporting more productive pastures than the existing ones. There are three common causes of this state of affairs—(1) Ravages of the grass-grub; (2) use of inferior strains of pasture species; (3) grazing management which leads to deterioration and lessened production of swards.

The ravages of the grass-grub are obvious, and at this season they call for the feeding-out of hay, silage, &c., on affected areas, and especially for the feeding-out of any hay in which useful plants contain seeds mature enough to be viable. Further, if the land responds to any form of top-dressing, then that form of top-dressing is advisable for the purpose of increasing the vigour of plants and stimulating their recovery from root-damage. However, so far, no type of top-dressing—*e.g.*, with lime salt, &c.—as a direct means of attacking the grubs has been found of value.

The use of inferior strains of pasture-plants which either are not persistent or are of low production, even under conditions of high fertility, is a frequent and fruitful cause of poorer pastures than the natural conditions warrant. The remedy is simple and normally can be carried out at a cost which makes its adoption distinctly profitable: it is the use of seed of the characters possessed by certified seed.

The most usual type of grazing management which leads to deterioration and lowered production of pastures is unfortunately very common; it is that in which unduly hard grazing takes place continuously in the winter and early spring and this is followed by insufficiently close grazing for most of the early summer. This type of grazing results in the punishment at a critical stage in each year's activity of species which make early growth—*e.g.*, rye-grass—and of the strengthening of species which make late growth—*e.g.*, brown-top. This tends to the eventual dominance of the brown-top and the suppression of the rye-grass. Ordinarily such a result is most readily avoided by one or both of two distinct courses—(1) Increased ensilage or haymaking which each reduces the summer surplus and builds up the winter feed-supply so that it tends to correct the grazing fault at both seasons; (2) the growing of special arable forage crops for use in winter, which likewise tends to correct both grazing faults.

From the preceding brief outline it becomes evident that the whole pasture position on individual farms may very fittingly be reviewed at this stage in the year's work if it has not already been done; the field work that should be done during the next few years and especially during the next twelve months should depend to a considerable extent upon the current general position on the farm in regard to grassland.

### Care in Winter Grazing.

Young pastures, and especially those in which permanency is desired, should be treated with much care at this season. "Poaching" or "pugging" leads to bare patches by means of which weeds gain a footing—

it is at times the primary cause of great numbers of such weeds as docks, buttercups, daisies, and thistles suddenly appearing. Sheep lessen the danger of "pugging" in comparison with cattle.

In trying to avoid "pugging" of young pastures one may fall into another fault—unduly lenient grazing—which readily brings about weakening of valuable species such as clovers. Young permanent pastures containing a considerable amount of Italian rye-grass are very prone to suffer from under-grazing because of the shading effect of the rye-grass upon the more slowly developing species. The other fault—over-severe grazing of young pastures—is in August the more prevalent one: it results in a setback to valuable species from which they may never recover fully.

### General Cropping Work.

In the main grain-growing districts the ploughing of land for cereals should take precedence over almost all other work. As a rule the best yields of spring wheat result from sowing in August and early September. The sowing of oats ordinarily should follow wheat as soon as opportunity offers.

Seed-treatment for disease-control of spring-sown cereals should not be omitted. The treatment of seed of oats and barley is more neglected than that of wheat, but nevertheless is well justified. Recent years have been marked by advances in seed-treatment associated with increased convenience and safety without sacrificing efficiency and economy, but strangely enough the advances in our knowledge are far from generally applied in practice. It is of importance that certain popular forms of seed-treatment must be carried out with exactitude. If the proper procedure is not followed carefully, one of two undesirable results is likely: either the disease is not controlled or the seed suffers injury. Sometimes injury is so extensive as to lead to the need of resowing or to a poor yield or to both resowing and a poor yield. Detailed information about seed-treatment is available from the Department of Agriculture.

Autumn-sown cereals if they are to produce chaff or grain should be given a final grazing about the end of August However, if because of the high fertility of the land "lodging" is expected, then the final feeding-off may quite well be deferred until September. Generally after the final feeding-off the crop may with advantage be tine-harrowed to loosen the surface and to distribute droppings as thoroughly as possible Feeding-off of cereals in the spring should be done by heavily stocking the area for a short period, and this preferably when the soil is as dry as possible. Harrowing of autumn-sown wheat may serve usefully to thicken thin crops, even when they have not been eaten off, by promoting tillering.

### Winter Utilization of Crops.

Faulty winter feeding often results when rations are not suitable in quality as well as quantity. It is not enough merely to provide a ration which fills the stomach—the required amount of nutriment should also be present. The feeding of stock mainly on straw or poor hay may be expected to result in poor nutrition, because the diet thus provided is too bulky in relation to its content of digestible nutritive matter. The feeding of roots alone leads to too much watery bulky material in the animal's diet. While it is mainly the bulkiness of roots which makes them unsuitable as a complete diet, straw and poor hay are unsuitable because both of their bulkiness and low digestibility.

If possible, grazing of lucerne during winter and early spring should be avoided: this is especially so in the case of young lucerne. Such grazing promotes the invasion of the lucerne by other plants, which, even if of some value—*e.g.*, rye-grass and clover—must be looked upon as weeds in the lucerne.

If any pastures are showing signs of grass-grub damage, but are not so extensively damaged as to be not worth repairing, then during the next few weeks the feeding of hay, silage, and roots may usually be concentrated

profitably on them: at this stage the grass-grubs return to near the surface from considerable depths, and so they are more subject to injury by the trampling of stock. Further, the trampling and the extra fertility induced by the feeding-out seems to be of value in assisting injured plants on which remnants of roots remain to recover more readily.

—*R. P. Connell, Fields Division, Palmerston North.*

# THE ORCHARD.

## Pruning.

EVERY endeavour should be made to complete this work as early as possible so that it will be finished before the spring activities—cultivation and spraying—are commenced. With regard to pruning, following the advice given in the notes of the previous months, those who have any difficulty in respect to the manner in which any particular trees should be pruned are advised to communicate with the Orchard Instructor stationed in the district and seek his advice.

All prunings, orchard refuse, and rubbish should be gathered and buried, either as the pruning proceeds or immediately it is finished. This is the surest and best way of destroying any pests and diseases of the trees which may be present in such materials.

## Spraying.

The overhaul of the sprayer before the spraying-season commences will save growers much loss of time and inconvenience later in the season. A thorough examination should be made of the machine, and all damaged or worn-out parts should be repaired or replaced. The moving parts of the pump and engine should be thoroughly cleaned and regreased. Examine and test the hose, and if faults are found new hose should be obtained. A supply of spare parts for repairs in case of emergency during the season should be obtained.

The fruitgrower has to contend with a large number of pests and diseases. Some of these cause extensive damage to the trees and the crops. Every grower should make a determined effort to decrease the amount of disease present in his orchard by orchard sanitation and spraying.

The first essential in treating insect or fungous disease is that the grower should identify correctly the pest and know something of its life-history in order that it may be correctly classified and the proper remedies applied for its control. After becoming acquainted with the life-history the orchardist has to consider and decide on a remedy which can be effectively applied. The remedies most commonly applied are briefly as follows:—

(*a*) *Poisons for Chewing or Biting Insects.*—An arsenical poison—arsenate of lead—which acts upon the stomach is the specific in general use for the control of codling moth, leaf-roller caterpillar, and pear or cherry slug, &c.

These should be applied to the foliage and fruit just before the pest makes its appearance.

(*b*) *Contact Sprays for Sucking Insects.*—The insects must be present when these sprays are applied, and the specifics are most efficient when they come in contact with the bodies or are inhaled through the breathing organs of the insects. At the present time lime sulphur, nicotine sulphate, winter (red) oil, and summer (white) oil are in most general use as contact sprays for the control of red mite, apple-leaf hopper, green and black aphis, and scales.

(*c*) *Fungicides for the Control of Fungi.*—The specifics should be applied before the spores of the disease have an opportunity of germinating and establishing themselves on the plant or fruit tissue.

Lime sulphur, bordeaux mixture, and colloidal sulphur are the fungicides in most common use for the control of black-spot, powdery mildew, leaf-curl, brown-rot, rust, shot-hole, and other fungous diseases.

(*d*) The use of the secateurs and the saw is recommended for the cutting-out, where practicable, of parts of trees badly damaged by insects, fungi, or bacteria.

### Cultivation.

If the land has not already been ploughed, every effort should be made to complete this work as soon as possible, so that cover-crops, grass, and fallen leaves, &c., may be turned in. This will give the crops and other vegetable matter turned in time to rot, and the elements which it contains will be made available when the tree requires them in the summer, when the fruit is maturing. Leaves affected by disease such as black-spot, for instance, will be buried and will have rotted, thus preventing the dissemination of disease from this source during the spring.

### Planting.

Growers intending to plant in the spring should arrange for early delivery of the trees, and, on their arrival, they should be " heeled in " in a suitable place at or near the orchard, ready for planting towards the end of August. The ground should be reasonably dry, and, if wet, the planting should be delayed until a later date, when the soil is in a suitable condition.

### Fruit in Storage.

This should now be examined frequently. Growers are advised to dispose, without undue delay, of fruit which has begun to shrivel or is showing signs of wilting or over-ripeness.

—*B. G. Goodwin, Orchard Instructor, Christchurch.*

### Citrus Culture.

*Packing.*—Last month notes on the packing of citrus fruits were given, the main points dealt with being the building of the bulge and the elimination of slackness in the pack. The type of packs used will now be dealt with. In the case of lemons and sweet oranges the fruits are packed on the "cheek" and the style of pack and the counts per box are the same as those used for apples and pears, except that the 3-2, 7-6, 5-layer 163 pack is seldom used, as it is generally not possible to get seven lemons in the rows lengthways. In its place the 3-3, 5-4, 6-layer pack of 162 is used. As in the case of " Small " grade lemons the sizes allowed are 270 to 350 counts to the standard box (10½ in. by 11½ in. by 18 in. inside measurement), the packs in these instances are not included on the apple-packing chart. A lemon-packing chart recommended reads as follows :—

| Style of Pack (Crosswise). | Number in Rows (Lengthwise). | Number of Layers (Depth). | Size or Count. |
|---|---|---|---|
| 3-2 .. .. .. | 5-5 | 5 | 125 |
| 3-2 .. .. .. | 6-5 | 5 | 138 |
| 3-2 .. .. .. | 6-6 | 5 | 150 |
| 3-3 .. .. .. | 5-4 | 6 | 162 |
| 3-3 .. .. .. | 5-5 | 6 | 180 |
| 3-3 .. .. .. | 6-5 | 6 | 198 |
| 3-3 .. .. .. | 6-6 | 6 | 216 |
| 3-3 .. .. .. | 7-6 | 6 | 234 |
| 3-3 .. .. .. | 7-7 | 6 | 252 |
| 3-3 (*a*) .. .. .. | 8-7 | 6 | 270 |
| 3-3 (*a*) .. .. .. | 8-8 | 6 | 288 |
| 4-3 (*a*) .. .. .. | 6-6 | 7 | 294 |
| 4-3 (*a*) .. .. .. | 7-6 | 7 | 319 |
| 4-3 (*a*) .. .. .. | 7-7 | 7 | 343 |
| 4-3 (*a*) .. .. .. | 8-7 | 7 | 368 |

The last six packs marked (*a*) are applicable to "Small" and "X" grades only. Lemons of this size are of little commercial value unless they are highly cured and full of juice.

The method of packing New Zealand grapefruit differs from that used for other fruits in that it is usually packed on the flat instead of on the cheek, and, as this method gives different counts to those obtained in packing in the ordinary way, a chart for use with the standard bushel case, for New Zealand grapefruit (Poorman orange) only, is given below:—

| Style of Pack (Crosswise). | Number in Rows (Lengthwise). | Number of Layers (Depth). | Size or Count. | Approximate Diameter. |
|---|---|---|---|---|
| | | | | Inches. |
| 2-1 .. .. | 3-3 | 5 | 45 | $4\frac{1}{4}$ |
| 2-2 .. .. | 3-2 | 5 | 50 | $4\frac{1}{8}$ |
| 2-2 .. .. | 3-3 | 5 | 60 | $3\frac{7}{8}$ |
| 2-2 .. .. | 4-3 | 5 | 70 | $3\frac{3}{4}$ |
| 2-2 .. .. | 4-4 | 5 | 80 | $3\frac{5}{8}$ |
| 2-2 .. .. | 5-4 | 5 | 90 | $3\frac{3}{8}$ |
| 2-2 .. .. | 5-5 | 5 | 100 | $3\frac{1}{4}$ |
| 3-2 .. .. | 4-3 | 6 | 105 | $3\frac{1}{4}$ |
| 3-2 .. .. | 4-4 | 6 | 120 | $3\frac{1}{8}$ |
| 3-2 .. .. | 5-4 | 6 | 135 | 3 |
| 3-2 .. .. | 5-5 | 6 | 150 | $2\frac{7}{8}$ |
| 3-2 .. .. | 6-5 | 6 | 165 | $2\frac{3}{4}$ |
| 3-2 .. .. | 6-6 | 6 | 180 | $2\frac{5}{8}$ |

NOTE.—See packs on the flat.

*Green Spot.*—This condition was described in the notes for March last, but is referred to again as it has been much in evidence in packing-sheds during the past few weeks. The trouble occurs mostly on green fruit, and is accentuated when picking is carried out when the fruit is wet with rain or dew, although the primary cause is rough handling. Care should be taken to avoid the conditions which are conducive to this trouble, as green-spot lowers the grade of the fruit and consequently its value.

*Replacements.*—In many of the older groves there are trees which, owing either to the ravages of disease or to the fact that their constitution has been weak, have reached the stage when they are no longer producing a satisfactory crop. Generally these are allowed to remain in the grove far too long. The owner should decide whether there is reasonable hope of bringing the tree into full bearing again by skeletonizing it and by soil-improvement, or whether the tree must be cut out without further delay. If the tree has had root trouble very extensively or if it is almost completely ring-barked through attacks of "bark-blotch," then it should be removed. A young tree should do quite well on the old site provided that a large hole is dug and filled in with fresh soil.

—*A. R. Grainger, Orchard Instructor, Tauranga.*

# POULTRY-KEEPING.

## Duck-keeping.

WHEN selecting breeding-ducks the same care and thought should be given as when selecting other breeding-birds. Firstly, select only pure-bred birds A study of the standard plates will indicate the type, while the letterpress thereunder states the breed characteristics. Vigour and constitution should be looked for, and the chief indication of this *sine quo non* is physical activity, together with a bright keen eye and well-developed body.

It is difficult to state a guide indicative of egg-production capacity in ducks, but on the whole it is advisable to select birds that show plenty of

length, with ample breadth and depth. Good breeding-birds usually have large, bold, prominent eyes which are set high up in the head ; in fact, it is seldom that the duck with eyes set low down in the side of the face is a good producer. The neck should be fairly fine. The front should be full with a well-developed abdomen. Slight indentation should show between front and abdomen. Breadth across the back is essential, and the legs must be set well apart. Two points that should be watched are, firstly, that the weight for the breed is kept up, and, secondly, that the length of the body is maintained to standard.

### Mating.

Only well-matured ducks should be bred from. As a rule ducks do not mature as early as fowls, but their laying-life is longer than that of the average hen. Two-year-old ducks mated to well-matured drakes at least ten months old will give good results.

As ducks are inclined to get overfat during their second and third years, especially after coming through the moult, they should be fed with care, as lack of care in this direction is often the cause of poor hatching results. The number of ducks to mate with each drake will depend on the conditions under which the birds are kept, their vigour, and age, but, generally speaking, from six to seven ducks to each drake of the Indian Runners or Khaki Campbells, and four or five ducks to each of the heavy breed drakes, should give good results.

Where the birds are on free range, more ducks may be mated with each drake. It is usually an indication that the drakes are under-mated if they fight a good deal. As there is no sure way of judging exactly how any particular mating is going to materialize it is always advisable to take the utmost care to arrange that only the very best and strongest birds are used for breeding purposes. Though many ducks will refuse to lay in nests it is most desirable to encourage them to use nests by supplying them with simple nests, such as a few bricks placed about a foot apart against one wall of their shelter. If a little straw is placed between these bricks it is quite possible to train a number of ducks to use such nests, when their eggs can be collected in a clean condition.

### Hatching Duck-eggs.

With the exception of the Muscovey, which take from thirty-five to thirty-seven days, all duck-eggs take twenty-eight days to hatch out, though many chip on the twenty-sixth day. Care should be taken to select eggs of good colour, shape, size, and texture of shell. Avoid the very large, bad-shaped, or rough-shelled eggs, as such eggs seldom hatch. It should be remembered that duck-eggs do not keep as well as hen-eggs, and that they lose their fertility more quickly. For these reasons they should be set within a week from the time of being laid ; in fact, the fresher they are when set the better. If hens are used for hatching purposes not more than from nine to eleven eggs should be placed under each hen. Better results will be obtained when the hen is set on the ground, and during the last week if the weather is dry it is advisable to sprinkle the eggs with a little warm water every other day. The hen can be quietly lifted off and replaced as soon as the eggs have been sprinkled. Care must be taken to see that the eggs are not chilled. Do not overdo the sprinkling, and if the weather is wet and the ground damp round the nest there will be no need for sprinkling.

The best results when hatching duck-eggs artificially are usually obtained when a little less ventilation and heat are allowed during the first week, and more moisture and ventilation during the last week of incubation, than that allowed when hatching hen-eggs.

The machine should be running at an even temperature of 100° F. when the eggs are first placed in the machine, and if the eggs are very cold the door of the machine can be left open for a few hours in order to allow the eggs to warm up gradually. If cold eggs are placed in an incubator and they

are heated up too quickly, a number of broken yolks is likely to be the result. A temperature of 102° F. for the first week, 103° F. for the rest of the period until the eggs start to chip, when 104° F., not higher, may be applied, should give good results. During the last ten days the eggs should be sprayed with a little warm water (about 103°) each day. This can be done either with a small brush or with the mouth. If the eggs are cooled in the morning the spraying should be done at night, but remember not to cool and spray at the same time, as such action will most likely cause the eggs to become chilled.

The incubator-ventilators may be almost closed during the first ten days, after which the ventilators can be gradually opened, but once the eggs start to chip it is advisable to open up the ventilators and not close them as is often recommended when hatching hen-eggs.

### Cooling and Turning.

The object of turning the eggs is to prevent the yolks from settling down towards the shell. The eggs should not be disturbed for at least thirty-six hours after placing them in the machine, then turn them once each day during the first week of incubation, and twice each day from then on until they start to chip, which is generally about the twenty-sixth day. It is essential that the eggs be handled gently, as jarring or rough handling is likely to cause deformed or crippled ducklings. As long as the eggs are moved gently it is not necessary that each egg be turned exactly over. It is, however, advisable to move them to different parts of the tray when turning, in order to give all the same units of heat, for all parts of the machine are not always exactly the same temperature.

During the first week the time taken to turn the eggs will be sufficient for cooling them, and then a few minutes extra each day until from thirty to thirty-five minutes are allowed during the last week. If it takes more than an hour and a half to get up the heat again, then less cooling should be allowed. The eggs should not be allowed to get cold, but be returned to the machine while just luke-warm. Never open the machine after the eggs start to chip until they have been given their full time to hatch.

### Brooding Ducklings.

Ducklings are not difficult to rear and will give less trouble than chickens, but they must have clean, dry, well-ventilated sleeping-quarters, and a supply of drinking-water within their reach at all times. The drinking-vessels must not be too shallow. The ammonia from damp, dirty bedding and poorly-ventilated sleeping-quarters are the cause of watery or sticky eyes in ducklings, and many young ducklings are lost each year from blind staggers brought on from giving them a drink and a feed at the same time after they have been too long without water. As previously mentioned, if it is found when it comes to feeding-time that their drinking-vessels are empty it is better to give them a drink before feeding, and if the morning is cold the chill should be taken off the water. The food should always be well mixed and not fed lumpy.

When brooding ducklings artificially they need much the same treatment as that given to chickens, but they do not require heat so long, and if it is gradually reduced after the first week they will get on well without heat after three or four weeks, provided they have a dry, clean bed, are not over-crowded, and have ample fresh air.

As is the case with feeding chickens, some duck-keepers have success with one system and others with a different one. A great deal depends upon how one feeds. The following is one method that has given good results :—

The first feed, which is given from thirty to thirty-six hours after hatching, is composed of equal parts of pollard and bran and a little rolled oats or oatmeal plus about 5 per cent. of sand or oyster-shell dust, the lot mixed to a crumbly state with skim-milk. This is fed four times a day for the first five days. From the sixth day add about 5 per cent. of meat-meal and a small quantity

of finely cut succulent green feed or boiled vegetables. After ten days increase the amount of meat-meal or boiled minced meat to 10 per cent., and also increase the amount of green feed. If on hand, maize-meal or barley-meal can take the place of the rolled oats. From two weeks' old three good feeds per day will be sufficient. Give all the brids will eat, but do not allow any food to be left to become sour. After the first week it is not necessary to mix sand with the mash, but it is essential that fine oyster-shell and gravel grit are always within reach of the birds.

When about eight weeks' old it is advisable to pick out the most promising birds for future breeders. Separate and fatten the rest for market by increasing the amount of maize-meal and barley-meal and reducing the amount of green feed. If ducklings have done well they should be ready for market at about eleven weeks old. When fattening for the market they need be given water to drink only at feed-time.

Ducklings must have ample shade from the sun, and the less they are disturbed the better. Ducklings can be hatched later than chicks, but if it is desired that young ones lay during April and May they should be hatched not later than October.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

## THE APIARY.

### Preparations for New Season.

By the end of August the beekeeper should have his preparations for the season's work well in hand. Hive and frame making, also the overhaul of all defective supers. roofs, and bottom-boards, should be undertaken in earnest. It is not wise to postpone the mechanical part of the work in the apiary until the bees themselves require the major portion of one's time. If increase is desirable—more especially where the apiary is being enlarged—ample provision should be made for it. It is most tantalizing to leave a swarm hanging on a tree while a hive has to be hastily put together.

Where the beekeeper does not make his own hives he should now order sufficient stocks to see him through the coming season. In most cases it does not pay to make one's own appliances. Hive-manufacturing in New Zealand has been brought up to a high standard, and unless the beekeeper has ample capital to purchase machinery to turn out good hives he will find the home-made article too costly in the long-run. Whether the beekeeper is working on a small or large scale he should aim at uniformity, and in building up an apiary decide at the beginning on the style of hive and frame he is going to use, and continue on these lines. Non-fitting supers and frames mean extra labour and lead to endless trouble in the long-run. The hives principally in use in the Dominion are the ten- and twelve-frame Langstroth, and experience of his district will enable the beekeeper to decide as to the best one to adopt. Careful inquiries should be made from beekeepers of long standing in the district as to the best style to use.

### Cheap Frame Hive.

Though there may not be much gained in the long-run by making any other than good substantial hives in the first place (especially by those who can construct their own), there may be those to whom the question of saving a shilling or two upon each hive is a consideration. In such cases the following directions for converting a benzine-case into a frame hive of the same dimensions as the standard Langstroth and which complies with the Apiaries Act should be of service :—

Procure a complete and sound case and carefully take it to pieces, then rabbet the ends of one edge to a depth of $\frac{7}{8}$ in. by $\frac{1}{2}$ in. to carry the frames. A tin rabbet should be nailed on the inside, to stand $\frac{1}{4}$ in. above, on which the

frames will rest. Now cut the sides so that they measure 20 in. Nail together, and this will give a hive the inside dimensions of which are 18¼ in. by 14¼ in. by 9⅜ in. A loose bottom-board may be constructed 24 in. by 15 in. wide. Nail on the board three strips of wood, ⅜ in. by 1 in., running along two sides and one end, so that when the hive is rested on the bottom-board it will leave an entrance ⅜ in. deep. Top of surplus boxes can be made in the same way. The best roof to use is a flat one. It may be made from the surplus timber of the benzine-case, and should telescope to a depth of 3 in. over the hive. Cover the top with ruberoid, zinc, or other waterproof material, and let it overlap the edges.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

# HORTICULTURE.

## Vegetable Crops.

MUSHROOM-GROWERS who had difficulty in keeping the shed temperature down in summer now find cropping curtailed by the low night temperatures experienced at this season, even with widely spaced beds and a heavy covering of straw. It is obvious the rough shed built of second-hand materials has a very limited use for growing this crop. To maintain a temperature of 50° to 60° F. at night during the winter period a fairly substantial building is required, unless the beds are made much deeper and well covered up, which is not to be recommended where the supply of compost is limited. For commercial cropping at all seasons an insulated building which can be thoroughly fumigated and sterilized is necessary. This is probably best provided by an asbestos-sheet lining with tightly packed shavings between it and the outer wall, which may be of asbestos or corrugated iron. The roof, outside, may be of iron, or timber covered with a thick burlap tarred and sanded. Well-fitted ventilators should be built into the base of the walls and in the roof, and the floor laid in concrete and drained. In the warmer localities very little artificial heating will be required in such a house, especially if it is built in a dry, well-drained position. The beds may be tiered at intervals of 2 ft. with at least 3 ft. between the top bed and the roof, and no straw covering need be used.

For cleaning, and to facilitate the working of the house, the bed boards of 8 in. by 1 in. rough timber should be laid loose; also the 6 in. by 1 in. side boards for the beds. Where extensive cropping is done the bottom bed should not be placed on the ground, but on boards 8 in. to 12 in. above it. Catch crops may be grown in all sorts of places, but only so long as the conditions may be controlled for the necessary period. There are, however, usually definite limitations to the period when conditions can be controlled except in a building which is specially equipped; such a place should therefore be provided where mushrooms are regarded as an important crop.

## Growing of Asparagus.

The life-period of perennial herbaceousplants varies widely; that of edible asparagus, *Asparagus officinalis*, is one of the longest—three or four years is the really productive life of most plants of this class, but good crops have been gathered from asparagus plantations four or five times as old as that. Apart from a good seed strain, production depends on good natural conditions and regular attention. This species is a native of Europe and Central Asia, where it is usually found growing by the sea-coast and river-banks. The light, deep, moist, well-drained soil found about estuarian flats in a temperate climate is its natural home, and such country should be selected for commercial production. The month of August, when the young plants are about to commence the new season's growth, is very suitable for setting out new

plantations. For this purpose graded one- or two-year-old plants are best. There must be no doubt as to the eradication of twitch and persistent weeds of every kind, the ground must be thoroughly clean, and if not naturally rich it should receive generous dressings of organic matter, which should be turned in deep. This plant is very partial to supplies of potash and nitrogen ; a generous potash dressing should therefore be included in the preparation of the land for planting. If a dressing of kainit has not already been applied, 3 cwt. per acre of sulphate or muriate of potash should be applied now.

In older countries extensive experiments have been carried out to ascertain the most profitable planting distances, and local experiences endorse most of their conclusions on this point : 18 in. between plants and 5 ft. or 6 ft. between rows—the wider space in the richer soil—is usually the optimum spacing for commercial crops. In the homestead garden a double row may be planted, 18 in. between plants, and the two rows making the double. If more is required, there should be an interval of 5 ft. before planting a further double row. Asparagus plants are set deep. The usual method is to plough out a furrow 10 in. deep, place the plants in position, and cover firmly with about 2 in. of soil, the remainder of the filling being made during the summer during subsequent cultivation while the plants are growing. The ultimate covering is about 8 in., or rather less if the land is inclined to be heavy. No cutting is done the first season after planting, but at the second spring growth a short cutting season of two weeks is done if good progress has been made.

Where asparagus plants are required for planting next year seeds of a good strain should be sown now so that a long season of growth will be obtained to enable sturdy plants to be produced. As with other seed-beds, it is important that weed-seeds near the surface should be germinated and destroyed before sowing, thus obtaining a clean seed-bed. To hasten germination asparagus-seed is soaked in hot water, about 85° to 90° F., for a period up to four or five days, the surface moisture is then dried off, and the seed sown at once. The sowing is made sufficiently thin to produce good plants at intervals of about 3 in. or 4 in —a depth of 2 in. to 3 in. and 24 in. to 30 in. between rows is usually most suitable.

### Treatment of Soil.

The asparagus crop is partial to an alkaline soil condition, and established plantations. unless given generous treatment during the summer immediately after the cutting season has finished, should now be given 6 cwt. basic super phosphate and 2 cwt. sulphate or muriate of potash per acre, and such prepared farm manure as may be necessary to maintain the supply of humus in the soil. In any case, early in the month of September a dressing of nitrate of soda 2 cwt. per acre should be applied and repeated at monthly intervals as may be necessary. The present dressing is broadcasted and disked in both ways and the land harrowed down—further cultivation being done between the rows as may be required.

Sooner or later during the month of August all of the early crops, including turnips, potatoes, globe beet, carrots, and peas, may be sown ; main crop parsnips, onions, artichokes, cabbage, cauliflower, lettuce, and parsley may also be sown. Towards the end of the month kumaras are bedded down on a hot-bed, and celery, melons, cucumbers, and half-hardy crops of most kinds are sown with a view to producing sturdy plants for setting outside in about two months' time, when hard frosts have about finished for the season.

In the larger establishments and in the colder districts the hot-bed often takes the form of a low, gable-roofed glasshouse, 12 ft. to 14 ft. wide, heated by means of hot water carried round the interior in 4 in. pipes, or by means of an electric cable bedded in sand on the bench. In smaller gardens the hot-bed is a stack of fermenting stable manure 2 ft. or 3 ft. high and sufficiently wide to have a margin of about a foot when a glass frame is placed on top. In warm districts less manure is necessary to maintain the desired temperature, which is about 55° to 60° at night. The preparation of the

stable manure will take about two or three weeks to bring it to the desired state of fermentation. More care is generally necessary in carrying out this operation. It is important that the material should be moist, and light sprinkling should be done when turning it, as is necessary, to maintain this condition; at the same time, it should not be exposed to heavy rain during treatment. Where stable manure is scarce lawn mowings and fallen leaves may be mixed in to assist in making up the desired quantity. The desired temperatures are more readily obtained in the hot-bed if it is made in a well-drained, sunny, sheltered spot, also when the frame is well built to exclude cold draughts and in cold wet weather it is well covered up at night. The precaution which is most important is to air the plants by adjusting the sash-lights, especially in the early morning on fine days. There is no doubt the most fertile cause of disease amongst these crops is just the neglect of this attention. Much water will not be required at this stage, but what is given should be tepid.

Parsnips and other mature roots in the ground towards the end of August should be lifted before a second growth commences and stored in a cool place.

### Small and Sundry Fruits.

The emphasis laid on the subject of ventilation of the tomato crop under glass during the period of October onwards has no application at the present time when the young plants have just been, or are about to be, planted out. There is no comparison between the two sets of conditions. The emphasis on generous ventilation is confined strictly to the summer period. The subject of ventilation requires much consideration and attention during the changeable weather of springtime in the unheated glasshouse to bring the plants along steadily without a check from a cold snap or being forced in high temperatures during a warm interval. Attention at this period is probably the most important factor in securing a good crop, and it must be given promptly so soon as any serious change in weather temperatures takes place.

For planting outside towards the end of October, and later, the tomato plants left over at the present time are unsuitable, as they will become stale and somewhat stunted. Sowings should be made at intervals from August onward to provide fresh plants for the outside crops, as steady growth without a check is indispensable for the best results. In this connection seed-strain, it should be remembered, is of the greatest importance. Vigour and health, as well as type, lie to a great extent in the strain of seed which is sown. For commercial cropping every care must be taken to obtain the most suitable.

### Chemical Spraying.

To obtain good crops of small fruit much can be done by sound, clean management, such as planting out healthy stock in fresh ground, also cutting out and burning old canes of raspberry, loganberry, &c., so soon as the crop is gathered. A certain amount of chemical spraying is also necessary, and that applied during early spring is probably of the greatest importance. For leaf-spot fungus (*Mycosphaerella fragariae*) attacking strawberry plants a 1-per-cent. Bordeaux spray—Bordeaux 4-4-40—should be applied during the month of August and repeated as necessary, which will be for some time in the more humid districts. During the summer period lime-sulphur solution, with a polysulphide content of 1 per cent., may be used—that is, one part of standard lime-sulphur concentrate to 150 parts water.

For cane-wilt fungus disease (*Leptosphaeria coniothyrium*), which is fairly common among raspberries, as well as other troubles of the kind, Bordeaux 5-4-50 is applied at bud movement and twice subsequently at about monthly intervals with Bordeaux 3-4-50.

Both gooseberry and currant bushes are affected with leaf-spot fungus disease (*Mycosphaerella grossulariae*). Where this occurs a spring application of Bordeaux 5-4-50 is desirable, which may be followed with advantage by an autumn application at the same dilution.

Probably the most serious disease of the passion-vine is the brown-spot found on leaves and fruit, also on leading growth, which may eventually be cinctured and cause long sections to die. This brown-spot, or die-back, disease is caused by a fungus which has been identified as *Gloeosporium fructiginum*. The best control is obtained by pruning the vines with secateurs so soon as hard frosts are over for the spring, and spraying with Bordeaux 6-5-50 just before blossoming, and repeating it at intervals as required at a strength of 3-5-50. The trouble is most acute during a wet growing season.

**The Homestead Garden.**

During recent years heavy losses of crop have been experienced because they have been exposed at critical periods to high winds accompanied by heavy rain. Live-stock in cold, open country has also suffered severely in winter, while in summer the absence of any shade is a discomfort to them, which is almost as serious. These losses can only be avoided by planting shelter-trees, which to be effective must be carefully selected and planted after giving full consideration to the past experience of the kind in the locality. Fencing-posts and firewood are also important considerations in the back country, and it is most convenient to grow them on the spot where they are required, instead of hauling them long distances. The months of August and September complete the planting season for trees of this kind, and to avoid the loss of another growing season work of that class should be carried out without delay in fine weather.

Such fruit and ornamental trees and shrubs as may be required about the homestead should also be planted now. Past experience has probably indicated the classes most suitable to the locality, and it is often best, in the main, to confine the selection to further species and varieties of those classes that have proved most suitable, thus providing a pleasing diversity which will flourish with a minimum of attention.

Seeds of hardy annuals may now be sown outside and half-hardy annuals in frames for planting out when spring frosts are over.

—*W. C. Hyde, Horticulturist, Wellington.*

# ANSWERS TO INQUIRIES.

**IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.**

## "THISTLE MOUTH" IN LAMBS.

A. W. M., Norsewood :—

What is suitable treatment or cure for the so-called disease "thistle mouth" commonly found on lambs at this time of the year? If not treated would the disease disappear eventually?

The Live-stock Division :—

The use of the term "thistle mouth" in the case of lambs apparently is a description of an ulcerative condition affecting the lips and nose of lambs resulting in the formation of thick crusts on these areas. The treatment consists of the removal of the affected lambs and their segregation on a pasture of fresh young feed, if this is available. The application of a weak antiseptic lotion such as a 1-per-cent. solution of lysol in water will assist in allaying the irritation to enable healing to take place. In cases where there is much "proud flesh" an astringent lotion of copper sulphate in water, using about 1½ oz. of bluestone per gallon of water, assists in the removal of the thick crusts and facilitates healing. Mild cases frequently recover when suitable pasture can be obtained and the irritating factor removed. It is, however, advisable to carry out some treatment as suggested. The selected lotion may be repeated after a few days, when healing quickly occurs.

### TREATING FOOT-ROT IN SHEEP.

R. J. D., Canvastown :—

What is the best treatment for the cure of foot-rot in sheep? A few sheep affected have been treated by paring the hooves and then treating the affected parts first with spirits of salts and finally with an ointment composed of equal quantities of stockholm tar and powdered bluestone.

The Live-stock Division :—

The treatment of foot-rot in sheep by means of trimming the hooves of affected animals and then applying a foot-rot ointment as outlined should prove satisfactory. The application of spirits of salts can be recommended only in certain cases, and it appears in your case that the use of spirits of salts followed by an application of the strong bluestone tar ointment may prove too caustic in its action. It is therefore recommended that a weaker tar ointment be applied after the hooves have been trimmed, and that you discontinue the use of the spirits of salts in the meantime. It is advisable to use an ointment composed of 1 part of bluestone to 3 parts of tar. The best drained paddocks should be selected for the affected animals until recovery takes place.

### CARE NEEDED IN FEEDING LUPIN-SEED.

T. W. H., Hororata :—

Could blue-lupin seed be used for feeding to pigs? Would crushing lessen their toxic effect? Could the seed be used as a winter ration for in-lamb ewes together with hay or straw?

The Live-stock Division :—

Blue-lupin seed is generally accepted as being less toxic than seed from the yellow variety. At the same time, it is necessary to recognize that a chronic disease known as lupinosis is known to follow the ingestion of any variety of lupin, whether plant or seed, the yellow lupin being considered to be the most toxic. Heavy mortalities among horses, cattle, sheep, and pigs have been attributed to the use of lupins. On account of the greater susceptibility of pigs to any foodstuff containing toxic matter, one cannot recommend the use of blue-lupin seed for this class of animal. The seeds are more harmful than the plant. Crushing will not lessen the toxic effect of lupin-seeds. The seeds can be fed to animals if they are well soaked and washed in water and the toxic principles leached out. A strictly limited amount of not more than ¼ lb. per head per day of unleached ground-up seeds may be fed to sheep when mixed with cut fodder. Up to 1 lb. per head per day may be given when the seeds are thoroughly leached. On account of the toxic alkaloids, one cannot recommend the use of the seeds for in-lamb ewes; in fact, it is advisable to limit any use that may be made of the seed to non-breeding stock.

### SOYA BEANS.

J. B. R., Remuera :—

Can you tell me if there is any variety of soya bean that is suitable for growing as a vegetable in a small garden?

Also what is the edible portion?

Does one boil the green pods after the style of French beans, or does one thresh the ripe beans out of the pods and cook them like haricot beans?

What is soya-bean flour? Can one make it from the ripe beans by grinding, say, in a coffee-mill?

Horticulture Division :—

The soya bean is not usually sold at present among the seeds for the small garden. The Sanitarium Health Food Co., have a variety which it is stated has been grown satisfactorily in the warmer parts of the country. The beans are cooked as haricots; they require to be soaked overnight and boiled for three hours, changing the water twice meanwhile. Better still, they may be boiled in a pressure cooker in about half an hour.

Soya-bean flour is one of the many products of these seeds. At present supplies are imported, and it is doubtful if simply drying and grinding the seeds would give a satisfactory product.

# WEATHER RECORDS: JUNE, 1937.

Dominion Meteorological Office.

NOTES FOR JUNE.

*General.*—June was a very cold month, and, in spite of the fact that over much of the country the rainfall was below normal, it was also a damp one in most districts. Except in places especially exposed to the southerlies or south-easterlies which prevailed throughout most of the month, winds were not strong. There was, consequently, little drying, and the soil is almost everywhere saturated with moisture. Work on the land has been difficult, and a smaller area than usual has been sown in wheat. After the first few days growth of pasture practically ceased, and the older material has deteriorated. Hand feeding has been resorted to to a considerable extent, but so far there is no shortage of feed. Stock are, on the whole, doing well, with the exception of hoggets, for which it has been a poor season. The milk-yield has fallen away rapidly. Vegetation in general does not appear to have suffered, and in many places flowering plants have done rather well.

*Rainfall.* — Rainfall was much above normal in the Auckland and Coromandel Peninsulas. Parts of North Auckland had double the average, and some severe flooding occurred there towards the end of the month. There were large deficits in most of Marlborough, Nelson, Westland, the interior of South Canterbury and Otago, and in the interior of the North Island. On the west coast and in the southern interior of the South Island it was a particularly fine month, with few wet days.

*Temperatures.*—Temperatures were everywhere below normal.

*Sunshine.*—Sunshine was much above normal on the west coast of the South Island and somewhat above, also, in Nelson and Blenheim and the southern portion of the South Island. At Waipoua, on the western side of the Auckland Peninsula, more than average was recorded.

*Pressure Systems.*—At the beginning of the month a cyclonic depression was located over the western Tasman Sea, while pressure was low to the east of New Zealand. This depression moved in a south-easterly direction till it reached southern New Zealand on the 4th as a deep westerly depression. Strong northerlies preceded it, there being gales in Cook Strait on the 4th. There was general rain with many heavy falls. On the 5th came a change to cold, strong southerlies, with widespread snowfalls. Hail and thunder also occurred in many places. On the 4th a small tornado did some local damage at Uruti, in Taranaki.

From this time onwards southerly or south-easterly winds and cold weather were persistent.

From the 7th to the 10th shallow depressions were passing to the north of New Zealand, and on the 12th a westerly depression affected the southern portion of the South Island.

From the 16th to the 18th a cyclonic depression crossed the central part of the Dominion, bringing much rain to the North Island, with some strong north-east to easterly winds in the Auckland Province.

On the 20th a cyclone developed off the coast of New South Wales. This became very deep and extensive and moved eastward very slowly. It crossed New Zealand on the night of the 24th. Very rough weather was associated with its passage across the Tasman. In New Zealand it caused strong easterly winds as it approached, and was followed by strong south-easterlies. These brought very cold weather and further extensive snowfalls. Several secondaries followed the main cyclone, moving from the north-west past the North Island. There was much rain in North Auckland and between Hawke's Bay and East Cape, with flooding in places, especially about Whangarei. The South Island, except for snow on the 24th, was comparatively little affected.

RAINFALLS FOR JUNE, 1937, AT REPRESENTATIVE STATIONS.

| Station. | Total Fall. | Number of Wet Days. | Maximum Fall. | Average June Fall. | Total Rainfall to Date. | Average Rainfall to Date. |
|---|---|---|---|---|---|---|
| *North Island.* | | | | | | |
| | In. | | In. | In. | In. | In. |
| Kaitaia .. .. | 7·14 | 13 | 2·35 | 6·59 | 35·90 | 28·16 |
| Russell .. .. | 20·43 | 15 | 6·15 | 6·67 | 63·72 | 30·63 |
| Whangarei .. .. | 18·40 | 21 | 6·27 | 6·54 | 51·76 | 31·60 |
| Auckland .. .. | 7·25 | 22 | 1·59 | 5·44 | 25·99 | 24·28 |
| Hamilton .. .. | .. | .. | .. | 5·11 | .. | 23·90 |
| Rotorua .. .. | 2·65 | 15 | 0·67 | 5·25 | 28·44 | 26·87 |
| Kawhia .. .. | .. | .. | .. | 5·72 | .. | 25·54 |
| New Plymouth .. | 5·92 | 16 | 1·22 | 5·95 | 32·08 | 28·54 |
| Riversdale, Inglewood .. | 5·98 | 14 | 1·32 | 10·27 | 51·59 | 48·65 |
| Whangamomona .. | .. | .. | .. | 7·89 | .. | 35·70 |
| Hawera .. .. | 3·17 | 13 | 1·00 | 4·41 | 22·74 | 21·39 |
| Tairua .. .. | 10·49 | 16 | 2·25 | 6·97 | 30·71 | 33·56 |
| Tauranga .. .. | 4·83 | 18 | 1·06 | 5·35 | 30·11 | 26·88 |
| Maraehako Station, Opotiki | 2·91 | 9 | 1·76 | 5·66 | 31·64 | 27·79 |
| Gisborne .. .. | 5·21 | 15 | 1·70 | 4·90 | 19·08 | 24·91 |
| Taupo .. .. | 2·11 | 14 | 0·44 | 4·56 | 18·31 | 21·36 |
| Napier .. .. | 2·98 | 14 | 1·06 | 2·92 | 11·57 | 16·08 |
| Hastings .. .. | 3·67 | 14 | 1·15 | 3·07 | 9·41 | 16·63 |
| Taihape .. .. | 2·84 | 20 | 0·52 | 3·38 | 17·66 | 17·81 |
| Masterton .. .. | 3·74 | 20 | 0·78 | 3·59 | 16·78 | 18·77 |
| Patea .. .. | 3·41 | 15 | 1·03 | 4·24 | 24·33 | 21·40 |
| Wanganui .. .. | 1·73 | 9 | 0·62 | 3·37 | 19·09 | 17·70 |
| Foxton .. .. | 0·99 | 10 | 0·33 | 3·39 | 13·12 | 15·27 |
| Wellington .. .. | 3·33 | 21 | 0·78 | 4·31 | 18·66 | 20·89 |
| *South Island.* | | | | | | |
| Westport .. .. | .. | .. | .. | 8·85 | .. | 46·50 |
| Greymouth .. .. | 3·96 | 12 | 1·22 | 8·80 | 56·10 | 49·56 |
| Hokitika .. .. | 3·97 | 11 | 1·18 | 9·22 | 59·62 | 55·09 |
| Ross .. .. | 5·03 | 7 | 1·60 | 8·73 | 71·64 | 62·77 |
| Arthur's Pass .. | .. | .. | .. | 10·53 | .. | 75·94 |
| Okuru, South Westland | 1·60 | 2 | 1·00 | 10·72 | 78·62 | 72·04 |
| Collingwood .. .. | 3·51 | 12 | 1·39 | 10·30 | 47·47 | 45·08 |
| Nelson .. .. | 1·25 | 6 | 0·75 | 3·51 | 18·61 | 18·32 |
| Spring Creek, Blenheim | 1·38 | 9 | 0·36 | 2·94 | 14·77 | 14·47 |
| Seddon .. .. | 1·84 | 10 | 0·59 | 2·09 | 13·30 | 12·32 |
| Hanmer Springs .. | 5·09 | 17 | 1·23 | 3·39 | 17·75 | 21·77 |
| Highfield .. .. | 4·10 | 13 | 0·95 | 2·47 | 12·29 | 16·74 |
| Gore Bay .. .. | 5·78 | 10 | 1·76 | 2·69 | 18·92 | 15·87 |
| Christchurch .. .. | 2·12 | 19 | 0·50 | 2·53 | 12·80 | 12·63 |
| Timaru .. .. | 0·96 | 7 | 0·39 | 1·75 | 13·23 | 11·14 |
| Lambrook Station, Fairlie | 0·80 | 6 | 0·25 | 1·86 | 11·61 | 11·98 |
| Benmore Station, Clearburn | 0·93 | 8 | 0·33 | 1·81 | 16·27 | 12·80 |
| Oamaru .. .. | 0·74 | 10 | 0·27 | 1·98 | 9·93 | 10·98 |
| Queenstown .. .. | 1·10 | 8 | 0·54 | 2·22 | 17·28 | 15·35 |
| Clyde .. .. | 0·13 | 3 | 0·07 | 0·92 | 10·13 | 7·76 |
| Dunedin .. .. | 3·25 | 15 | 0·88 | 3·14 | 26·57 | 18·08 |
| Wendon .. .. | 2·06 | 12 | 0·79 | 2·59 | 27·70 | 15·48 |
| Balclutha .. .. | 2·24 | 18 | 0·37 | 1·99 | 21·72 | 12·71 |
| Invercargill .. .. | 2·90 | 20 | 0·75 | 3·64 | 24·83 | 23·31 |
| Puysegur Point .. | 6·02 | 20 | 1·52 | 6·59 | 48·30 | 42·26 |
| Half-moon Bay .. | .. | .. | .. | 4·91 | .. | 29·13 |

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## PIG INDUSTRY.

### BREEDING AND FEEDING FOR THE MARKET.

*(Continued.)*

M. J. SCOTT, Superintendent of the Pig Industry.

A COMBINED herd-book is issued under the auspices of the New Zealand Pig-Breeders' Association. One volume is issued each year, and about eighteen volumes have been issued to date. There are about 360 registered breeders in New Zealand, of whom about 190 breed Tamworths, about 100 Berkshires, forty Large Whites, and thirty Large Blacks, less than ten Middle Whites, and one or two Duroc Jerseys. From these breeds all sorts of crossbred pigs are produced and offered for sale on the English market in competition with a single distinctive line offered by other competitors for the trade. A moment's reflection will make it obvious that by gratifying the valueless idiosyncrasies of individual breeders we have done ourselves a great national disservice, without any individual actually getting any especial reward beyond his own satisfaction.

It should be possible without doing any injury to individuals to eliminate all but two breeds in the course of a few years, and from those remaining to produce a half-bred pig that would supply both the porker and baconer trade. It seems an easier problem to select and multiply good Tamworths and Berkshires, now widely distributed, than to improve our Large Whites or the conditions under which these are kept till we can be sure they will be satisfactory. In the end one or other of these plans must be followed if pigs continue to develop and the industry expands as it is capable of doing.

#### USE PURE-BRED STOCK.

As the pig industry has developed, so the importance of quality has increased. The English trade classes pigs into the following groups :—

| | Approximate Dead Weights. |
|---|---|
| Porkers .. .. .. .. | 61 to 80 lb. |
| Porkets .. .. .. .. | 81 to 100 lb. |
| Cutters .. .. .. .. | 101 to 120 lb. |
| Baconers .. .. .. .. | 121 to 170 lb. |

In addition, pigs of all weights below 60 lb. and all weights above 170 lb. are marketed in some part of England, but as a rule the 61 lb. to 80 lb. class is most popular, and gets a small premium. The next most popular is the bacon class, 130 lb. to 170 lb. General satisfaction is expressed at the quality of our porkers, but our baconers are either too short and light or too fat and heavy.

Generally they lack uniformity, and this can be most easily acquired by using standard types of breeding-stock. These standard types are fixed with greater certainty in purebred strains than they are in crossbred pigs, and, whatever the advantages of crossbred sows for breeding purposes, they are outweighed by the national good that would arise from marketing uniform pigs.

### The Boar.

The importance of using a good boar can never be over emphasized. Pigs provide only carcass: there are neither wool nor milk factors to confuse the issue. All that is wanted is a good carcass, produced by quick-growing, efficient feed-converters. Pedigree breeders produce as many boars as sows each year, and since only a few boars are wanted there must be a very rigorous selection going on. Get a boar whose parents have proved their prolificacy, rapidity of growth, and ability to use feed efficiently. Up to the present a buyer has had to depend upon the integrity of the pedigree breeder, and while there are many who are satisfied with this arrangement, there are many who demand the testing of pedigree pigs, and a national testing service was instituted last year. This will expand and develop, and before long it should be possible to provide boars of proved ability. This should establish better relations between buyers and sellers, and encourage the wider use of pedigree stock for commercial pig-production. From a national point of view purebred boars should be used in order to produce uniform pigs. By this means we can most quickly establish that uniformity that is the hall-mark of quality.

Whatever the boar, he must be vigorous, active, and masculine, without being unduly coarse. Width between the legs, flat bone, nice-quality silky hair, alert carriage, standing well up on the toes, freedom from wrinkles, and evenness of temper are some of the external attributes of the good boar. He should have twelve to fourteen rudimentary teats evenly spaced and well forward on to the breast. Boars should be kept in a paddock by themselves, and fed as carefully as any other animal. If the boar is run with the sows it is impossible to keep farrowing dates, and, as a result, some sows must be abused. A boar may be used for a few sows at six months old, but he is given a better chance to develop and grow if he is not used until he is eight or even ten months old. It is advisable to detusk all boars, an operation that is quickly and easily done by tying the boar to a post or putting him in a bail (useful for ringing pigs) and cutting out the tusks with a wood-chisel.

### The Sow.

It goes without saying that if efforts are spent in getting a good boar equal care must be given to the choice of a sow. As a rule the boar stamps his general outward appearance on his progeny, but it is claimed that the sow transmits stamina, ability to grow, and other non-visible health characters. Sows are often bought as weaners, and at that stage the only means of judging them is by their parents—usually their mother. A sow should have at least twelve to fourteen well-placed teats extending well on to the breast, be of quiet disposition, with plenty of length, good quarters, and well-sprung ribs. The thick, short-necked, narrow, or leggy or heavy-shouldered sow is not wanted. Never use sows or boars

out of litters that show any sign of rupture or other irregularity of testicle development in the boars of the litter. Rupture is an inherited weakness that must be present in both parents before it comes out in the offspring. Keep it out of breeding-stock by avoiding pigs from litters that show any sign of it.

A sow may be mated at six to seven months if particularly well grown, but such a sow will remain small till about the fourth litter. If well fed she will give just as good litters as well-grown sows can, but she will go to pieces on a poor feed-supply quicker than a matured sow. It is more general to wait till sows are eight months old—some let them go to ten months—before serving them. They produce bigger litters each time up to about the fourth or fifth, but at weaning the maiden sow may have as many and as good pigs as the older sow. As a rule the younger the sow the more careful she is to rear all the pigs born, and at about the sixth litter the element of carelessness has become so pronounced that from this stage onward the number of pigs reared per litter gradually falls off. Records show the following results for a number of sows :—

| — | First Litter. | Second Litter. | Third Litter. | Fourth Litter | Fifth Litter. | Sixth Litter. | Seventh Litter. | Eighth Litter. | Ninth Litter. | Tenth Litter. |
|---|---|---|---|---|---|---|---|---|---|---|
| Average number born | 9 | 10 | 11 | 12 | 13 | 14 | 14 | 14 | 14 | 14 |
| Average number reared | 6·8 | 7·2 | 7·8 | 8·2 | 8·0 | 7·0 | 6·0 | 5·0 | 5·0 | 5·0 |
| Average weight per piglet (lb.) | 35·0 | 35·5 | 36·0 | 36·5 | 37·0 | 37·0 | 40·0 | 40·0 | 40·0 | 40·0 |

## Renewal of Sows.

Although there are many good litters produced from sows that are over four years old, it pays to renew most sows after the sixth litter—*i.e.*, after they are three and a half years old. They have to fail sometime, and collected information shows that on the average they begin to fail after the sixth litter. It is possible to keep each sow until she actually does fail, but, since sow-renewal can be arranged so that it does not cost a great deal, it is safer to keep young sows. Kindly treatment of sows is as valuable as the best of feed and shelter, and costs nothing. Where sows are abused either by man or by circumstances, there one finds most trouble from pigs being eaten at birth and from being overlain. Being in harmony with her surroundings makes a sow profitable, and for this reason it is worth while confining a sow to her farrowing quarters fully three weeks before she farrows. She has time to adjust herself to possible changes of food, or temperature, or shelter, or outlook, or noise, or any of the things that may upset an overburdened matron. To guard against rough weather during the first two or three days after farrowing, it is probably safer to have the sow shut up for farrowing. Farrowing comes but once a year (or is it twice ?), and dead pigs show no profit, however carefully plans have been made for the other 364 days of the year !

Sows repay the owner for careful attention during the time they are suckling a litter, and just prior to this. Every one who has owned a sow knows what this means, and it is within most people's compass to provide that attention when they realize that it is worth while doing so.

### Care of the Litter.

The litter lives on the sow's milk till they are about three weeks old. Just before this age is reached it is advisable to start the youngsters feeding on their own account. This is done with whole cow's milk most easily, but they can be encouraged to take any feed, and if they do this from their own trough behind a creep that keeps the sow away they are more likely to keep healthy and to feed better. At about three weeks old the litter often goes off a little, either through scours or some other infection, or if the litter is big, through insufficient to eat. Timely attention that tides them over this period gives them a better chance. A sod of fresh soil put in the pen daily often keeps them healthy, perhaps because of the iron or other element they get out of the soil, or perhaps because the earth performs some detoxicating action in their digestive system. Three weeks is a good time to castrate, the pigs are easily handled, are not so active as to do themselves any injury by racing round or fighting or getting into the dirt. Most of the rejects at the works due to faulty castration would be avoided if pigs were castrated earlier.

It has been observed that a further check often takes place at five weeks. This usually happens if the pigs are not by this time eating out of the troughs fairly readily. Weaning takes place as early as six and as late as ten weeks after farrowing. It is best to remove the sow and to keep on feeding the weaners for another month so as to keep them growing as fast as they will. There is only one way to do this. Give them as much as they will eat of good pig-food—fibrous foods are not suitable at this age—feed them regularly and cleanly, and keep them warm and dry. The sow comes on heat within three to five days after weaning, and should be put to the boar as late in the heat as possible. If she is missed at this stage, she is often difficult to get in pig later, because no automatic flushing occurs except at weaning-time. If she has been missed after weaning, shut the sow up and feed her well till she does come on heat.

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# POULTRY-FEEDING EXPERIMENTS, 1936-37.

W. L. Jourdain, Poultry Overseer, Government Poultry Farm, Wallaceville.

An experiment was carried out at the Wallaceville Poultry Station over the ten months from 1st April, 1936, to 31st January, 1937, for the purpose of ascertaining the respective merits for egg-production, of the following five methods of feeding: soaked wheat; soaked barley; bran and pollard mash; bran, pollard, and wheatmeal mash; and dry mash.

Two hundred pullets were used for the test, and were divided into five different pens of forty birds each as uniformly as possible. The houses were also of the same size and type throughout.

Feeding was carried out as follows: The birds in pens 1 and 2 each received two meals of soaked grain per day, one about 7 a.m. and the other about 4 p.m.; those in pens 3 and 4 received one mash meal per day about 7 a.m. and one grain meal per day about 4 p.m.; and those in pen 5 had the dry mash before them all the time, and in addition received a grain meal about 4 p.m. In addition approximately 2 lb. of oats were fed to each pen in the litter every midday as a scratch grain to induce them to "work," and after they had been given their last

meal at about 4 p.m. they were all given green food in the form of young green oats and silver beet. Oyster-shell and gravel grit was also supplied *ad lib.*

*Pen 1. Soaked Wheat.*

The method of feeding adopted with this pen was as follows :—

The amount of wheat required for each meal was first soaked in water for twenty-four hours. The water in which the wheat was soaked for each meal had approximately 1 per cent. of salt dissolved in it. For the morning meal the soaked wheat was dried off with the bran mixture (see Table 1), and for the evening feed it was dried off with plain bran and green food ; the amount of green food was approximately one-third of the total mixture of bran, wheat, and green food.

The amounts of food prepared and stored each time was as follows :—

*Table 1.*

| Bran Mixture. | Bran. | Wheat. |
|---|---|---|
| 17 lb. bran.<br>11 lb. meat-meal.<br>2 lb. linseed-meal.<br>—<br>30 lb | 30 lb. | 100 lb. |

The amount of meat-meal averaged approximately 10 per cent by measure of the wheat.

The birds in this pen, in common with pen 2, were transferred from the normal feeding—mash in the morning and grain in the evening—to the soaked wheat at morning and evening within a fortnight. The result of this drastic change was to put practically all the birds in these pens into a full moult within a month.

Several times it was noticed that the birds seemed to get tired of the soaked wheat and then in a few days they returned to their usual amount of feed. These birds did not consume as great an amount of soaked wheat as the amounts of foods consumed by the other pens in the test, with the exception of those on soaked barley. Never at any time did the pen 1 birds lay as well as the birds being fed on mash and grain diets.

*Pen 2. Soaked Barley.*

The method of feeding adopted with this pen was exactly the same as for pen 1 except that barley was substituted for wheat in the ration, which was as follows :—

*Table 2*

| Bran Mixture. | Bran. | Barley. |
|---|---|---|
| 17 lb. bran.<br>11 lb. meat-meal.<br>2 lb. linseed-meal.<br>—<br>30 lb. | 30 lb. | 100 lb. |

The amount of meat-meal averaged approximately 10 per cent. by measure of the barley.

Comparing this pen with pen 1 very little difference was seen as far as the amount of food consumed was concerned, there being 147 lb. less

barley (see Table 6). Of course the difference between the prices of wheat and barley would give a further advantage still in the feeding-costs, but the smaller number of eggs from the barley pen would to a great extent offset that advantage.

There was a fairly heavy mortality with both pen 1 and pen 2. The majority of deaths in both these pens was due to vent-picking. To try to prevent this the amount of meat-meal was reduced considerably later in the experiment.

These birds never seemed to tire of the ration of soaked barley, although they never at any time ate a very great deal at a meal, appearing to be satisfied with less bulk than the birds on soaked wheat.

The birds in this pen, as mentioned before, went off into a heavy moult just after the commencement of the test, thereby affecting the egg-production considerably.

### *Pen 3. Bran and Pollard Mash.*

This pen received only bran, pollard, and meat-meal in their mash, the mixtures for the mash and grain meals being as follows :—

*Table 3.*

| Mash Mixture. | Grain Mixture. |
| --- | --- |
| 32 lb. pollard. | 60 lb. wheat |
| 9 lb. bran. | 20 lb. maize |
| 9 lb. meat-meal | 20 lb barley. |
| 1 lb. linseed-meal. | — |
| — | 100 lb. |
| 51 lb. | |

The meat-meal was approximately 10 per cent. by measure.

The birds on this ration were always in the best of health, and always hungry and ready for their food. This pen ate more than any of the other pens at the commencement of the experiment and continued to do so until the finish.

The egg-production of this pen never dropped to the same extent as the two pens on the soaked grains, probably because there was not such a radical change in the system of feeding, and therefore there were not so many birds which dropped into a moult.

### *Pen 4. Bran, Pollard, and Wheatmeal Mash.*

This pen was given bran, pollard, wheatmeal, and meat-meal in their morning mash and mixed grain in the evening as follows :—

*Table 4*

| Mash Mixture. | Grain Mixture. |
| --- | --- |
| 18 lb. bran. | 60 lb. wheat. |
| 32 lb. wheatmeal. | 20 lb. maize. |
| 14 lb. pollard. | 20 lb. barley. |
| 13 lb. meat-meal. | — |
| — | 100 lb. |
| 77 lb. | |

The meat-meal was approximately 10 per cent. by measure.

The mash-mixture for this pen was the standard mash used at this Station, and this pen was therefore the control pen for the whole experiment.

One bird in this pen died through digestive disorder, one with abdominal dropsy, two with ovarian trouble, and the other two were vent-picked.

These birds never went into a moult and never dropped in egg-production as much as any of the other pens in the experiment. It was naturally expected that they would not do so, as there had been no change in their diet or their treatment. The only reason why the birds in either this pen or the dry-mash pen (pen 5) should go into a moult would be that they had perhaps commenced to lay very early in the season. However, they did not lay as many as pen 3 even though pen 3 dropped more in production shortly after the test commenced.

### *Pen 5. Dry Mash.*

This pen of pullets had been reared on dry mash since they were day-old chicks, and there had been no change in their diet since they were three months old. The dry mash with which they were fed was made up as follows:—

*Table 5*

| Mash Mixture | Grain. |
|---|---|
| 50 lb. maize-meal.<br>16 lb bran.<br>16 lb. pollard.<br>4 lb. meat-meal<br>4 lb. milk-powder.<br>4 lb. linseed-meal<br>2 lb. bonedust.<br>½ lb salt.<br>96½ lb. | Wheat |

After these birds commenced to lay (which was before the experiment started) they went right ahead, with the exception of a few weeks just after the beginning of the experiment, when they seemed to be at a standstill. However, after they got over that period they went ahead rapidly and laid well, finishing about 700 eggs ahead of the next highest pen.

Even though they had the dry mash before them all the time, they still gave every indication that they relished their grain feed at 4 p.m.

The following tables give—

(1) The costs and the amounts of food consumed (Table 6):

(2) The number of eggs laid and the amount received for them (Table 7).

*Table 6.—Quantities and Costs of Food consumed.*

| Foodstuff. | Average Price. | Pen 1. Quantity used. | Pen 1. Cost. | Pen 2. Quantity used. | Pen 2. Cost. | Pen 3. Quantity used. | Pen 3. Cost. | Pen 4. Quantity used. | Pen 4. Cost. | Pen 5. Quantity used. | Pen 5. Cost. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Lb. | £ s. d. | Lb. | £ s. d. | Lb. | £ s. d. | Lb. | £ s. d. | Lb. | £ s. d. |
| Wheat .. | 5s. 9·25d. per bushel | 1,965 | 9 9 0 | .. | .. | 1,020 | 4 18 1 | 810 | 3 17 11 | 1,182 | 5 13 8 |
| Barley .. | 3s. 4·83d. per bushel | .. | .. | 1,818 | 6 3 8 | 340 | 1 3 2 | 270 | 0 18 4 | .. | .. |
| Oats .. .. | 4s. per bushel .. | 614 | 3 1 5 | 614 | 3 1 5 | 614 | 3 1 5 | 614 | 3 1 5 | 614 | 3 1 5 |
| Maize.. .. | 6s. 10·91d. per bushel | .. | .. | .. | .. | 340 | 2 1 11 | 270 | 1 13 4 | .. | .. |
| Bran .. .. | £6 5s. 8d. per ton .. | 375 | 1 3 7 | 353 | 1 2 2 | 214 | 0 13 5 | 249 | 0 15 8 | 254 | 0 15 11 |
| Pollard .. | £7 3s. 8d. per ton .. | .. | .. | .. | .. | 763 | 2 14 10 | 192 | 0 13 10 | 253 | 0 18 2 |
| Meat-meal .. | £7 6s. 8d. per ton .. | 125 | 0 9 2 | 107 | 0 7 10 | 234 | 0 17 2 | 180 | 0 13 2 | 65 | 0 4 9 |
| Wheatmeal .. | £9 15s. per ton .. | .. | .. | .. | .. | .. | .. | 442 | 2 3 1 | .. | .. |
| Maize-meal .. | £12 15s. per ton .. | .. | .. | .. | .. | .. | .. | .. | .. | 792 | 5 1 0 |
| Linseed-meal .. | 15s. per 100 lb. .. | 23 | 0 3 5 | 21 | 0 3 2 | 24 | 0 3 7 | .. | .. | 63 | 0 9 5 |
| Oyster-shell grit | 4s. 6d. per 100 lb. .. | 100 | 0 4 6 | 100 | 0 4 6 | 131 | 0 5 11 | 106 | 0 4 9 | 131 | 0 5 11 |
| Milk-powder .. | £2 9s. per cwt. .. | .. | .. | .. | .. | .. | .. | .. | .. | 63 | 1 7 7 |
| Bonedust .. | 9s. 6d. per cwt. .. | .. | .. | .. | .. | .. | .. | .. | .. | 32 | 0 2 9 |
| Salt .. .. | 1d. per lb. .. .. | 9½ | 0 0 10 | 9½ | 0 0 10 | .. | .. | .. | .. | 8 | 0 0 8 |
| Total costs | .. | .. | 14 11 11 | .. | 11 3 7 | .. | 15 10 6 | .. | 14 1 6 | .. | 18 1 3 |

*Table 7.—Eggs laid and Amount received in respect of each Pen*

| Month. | Average Price per Dozen. | Pen 1 | | | | Pen 2 | | | | Pen 3 | | | | Pen 4 | | | | Pen 5. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Dozen. | Value | | | Dozen | Value. | | | Dozen. | Value | | | Dozen | Value. | | | Dozen. | Value. | | |
| | | | £ | s. | d | | £ | s. | d. | | £ | s | d | | £ | s. | d. | | £ | s. | d. |
| April .. .. .. | 2s. 3·8d. .. | $20\frac{7}{12}$ | 2 | 7 | 8 | $14\frac{3}{12}$ | 1 | 14 | 0 | $26\frac{1}{12}$ | 3 | 0 | 10 | $31\frac{6}{12}$ | 3 | 13 | 0 | 56 | 6 | 9 | 9 |
| May .. .. .. | 2s. 4·5d. .. | $13\frac{7}{12}$ | 1 | 12 | 3 | $12\frac{4}{12}$ | 1 | 9 | 4 | $19\frac{6}{12}$ | 2 | 6 | 4 | $22\frac{5}{12}$ | 2 | 13 | 10 | $31\frac{10}{12}$ | 3 | 15 | 7 |
| June .. .. .. | 1s. 10·8d. .. | $23\frac{5}{12}$ | 2 | 5 | 0 | $26\frac{2}{12}$ | 2 | 9 | 8 | $24\frac{11}{12}$ | 2 | 7 | 4 | $27\frac{6}{12}$ | 2 | 12 | 3 | $33\frac{11}{12}$ | 3 | 4 | 5 |
| July .. .. .. | 1s 4·5d. .. | $32\frac{7}{12}$ | 2 | 4 | 10 | $47\frac{1}{12}$ | 3 | 4 | 11 | $51\frac{4}{12}$ | 3 | 10 | 7 | $39\frac{2}{12}$ | 2 | 13 | 10 | $49\frac{5}{12}$ | 3 | 7 | 11 |
| August .. .. | 1s. 3·8d .. | $49\frac{4}{12}$ | 3 | 5 | 0 | $48\frac{9}{12}$ | 3 | 4 | 2 | $62\frac{4}{12}$ | 4 | 2 | 1 | $57\frac{7}{12}$ | 3 | 15 | 10 | $62\frac{11}{12}$ | 4 | 2 | 10 |
| September .. .. | 1s. 0·75d. .. | $59\frac{1}{12}$ | 3 | 2 | 9 | $46\frac{10}{12}$ | 2 | 9 | 9 | $64\frac{1}{12}$ | 3 | 8 | 1 | 61 | 3 | 4 | 10 | $67\frac{9}{12}$ | 3 | 12 | 0 |
| October .. .. | 1s 2·125d. | $56\frac{11}{16}$ | 3 | 7 | 0 | 50 | 2 | 18 | 10 | $68\frac{3}{12}$ | 4 | 0 | 4 | $59\frac{4}{12}$ | 3 | 9 | 9 | $69\frac{9}{12}$ | 4 | 2 | 1 |
| November .. .. | 1s. 3·4d .. | $52\frac{5}{12}$ | 3 | 7 | 7 | $48\frac{5}{12}$ | 3 | 2 | 2 | $64\frac{4}{12}$ | 4 | 2 | 6 | $53\frac{4}{12}$ | 3 | 8 | 5 | $63\frac{4}{12}$ | 4 | 1 | 4 |
| December .. .. | 1s 5·5d. .. | $46\frac{7}{12}$ | 3 | 7 | 11 | $34\frac{11}{12}$ | 2 | 10 | 11 | 56 | 4 | 1 | 8 | $49\frac{6}{12}$ | 3 | 12 | 2 | $57\frac{11}{12}$ | 4 | 4 | 6 |
| January .. .. | 1s. 6·5d. .. | 40 | 3 | 0 | 10 | $34\frac{6}{12}$ | 2 | 12 | 6 | $49\frac{1}{12}$ | 3 | 14 | 8 | $52\frac{5}{12}$ | 3 | 19 | 9 | $51\frac{1}{12}$ | 3 | 17 | 8 |
| Totals .. .. | .. | 395 | 28 | 0 | 10 | $363\frac{10}{12}$ | 25 | 16 | 3 | $486\frac{1}{12}$ | 34 | 14 | 5 | $453\frac{11}{12}$ | 33 | 3 | 8 | $543\frac{11}{12}$ | 40 | 18 | 1 |

*Table 8.—Net Profit over Cost of Foods.*

| Pen No. | Number of Birds at Start of Test. | Number of Weeks. | Approximate Average Number of Birds during Test. | Total Number of Eggs Sold (in Dozens). | Amount received for Eggs. | Total Cost of Food. | Differences. |
|---|---|---|---|---|---|---|---|
| | | | | | £ s. d. | £ s. d. | £ s. d. |
| 1 .. | 40 | $39\frac{1}{2}$ | 37 | 395 | 28 0 10 | 14 11 11 | 13 8 11 |
| 2 .. | 40 | $39\frac{1}{2}$ | 35 | $363\frac{10}{12}$ | 25 16 3 | 11 3 7 | 14 12 8 |
| 3 .. | 40 | $39\frac{1}{2}$ | 39 | $486\frac{1}{12}$ | 34 14 5 | 15 19 6 | 18 14 11 |
| 4 .. | 40 | $39\frac{1}{2}$ | 36 | $453\frac{11}{12}$ | 33 3 8 | 14 1 6 | 19 2 2 |
| 5 .. | 40 | $39\frac{1}{2}$ | 38 | $543\frac{11}{12}$ | 40 18 1 | 18 1 3 | 22 16 10 |

### SUMMARY.

The details given in the last table (Table 8) reveal the result of the experiment at a glance. It will be seen from this that the cost of food for pen 5 was considerably more than that of any of the other pens, costing £2 1s. 9d. more than the next highest. Against the higher cost, however, these birds laid more eggs than any other pen, thereby more than paying for the extra cost of feed. As will be seen, the two pens on soaked grains gave the poorest results in this test ; but, considering that the majority of these birds went into a moult soon after the experiment commenced, it would not be fair to compare their results with those of pen 5.

Another point of interest is that the pullets in both pens 4 and 5 were sexed pullets—that is, sexed as day-old chicks—whereas the other pullets in pens 1, 2, and 3 were not sexed. The results of the test would therefore prove that sexing does not harm the pullet in any way as far as egg-production is concerned.

The results of this experiment is not taken as conclusive, and therefore a further experiment along the same lines is being carried out during 1937–38.

# MULCHING OF CITRUS TREES.

SEVERAL growers in the Auckland District are paying more attention to mulching their citrus trees in order to get a greater supply of organic matter into the soil. This work has been going on for several years, and the advantage is now to be plainly seen, first in the dark-green foliage with a smooth surface, and secondly in the skin of the fruit itself, which is very smooth and clear.

In both instances where this is done the method is to have a separate field in which the grass or clovers are grown, and this is cut during the late summer, and the material placed around the trees well out to the spread of the branches. This material very soon decays and mingles freely with the soil, and by this means it is kept in a good mechanical condition such as the tree requires in order to flourish. A certain quantity of artificial manure is also used, but the quantities have been reduced by nearly half since the mulching has been carried out.

This practice may also be applied with other fruits where it is practicable, and material for mulching purposes can be obtained especially in those localities where the soils are deficient in organic matter.

# WHEAT-VARIETY TRIALS.

## OPERATIONS FOR SEASONS 1935-36 AND 1936-37.

J. W. WOODCOCK, Crop Experimentalist.

THE wheat-variety trials conducted by the Fields Division over the past two seasons have been mainly directed towards the testing-out in various districts of new varieties which are either foreign wheats introduced by, or crosses bred by, the Wheat Research Institute. In each experiment an endeavour is made to select a locality characteristic of the district. In testing out a new variety its characteristics are taken into account when selecting the localities for trials, as well as the ecological conditions of these localities, so that, taking all experiments of the variety, a wide range of ecological conditions is covered. Close collaboration is now maintained between the Institute and the Fields Division, not only in the general field trials, but also in the preliminary work which involves the final selection of some dozens of crossbred lines, and the institution of "ecological trials" in several districts is of some assistance to the geneticist, Dr. Frankel, in selecting those lines which show promise.

### VARIETIES UNDER TRIAL.

In the experiment under review either Solid Straw Tuscan or Cross 7 have been taken as the standard variety with which the others were compared. In most cases both the above were included.

*Marquis.*—Trials with this variety were confined to Marlborough, where it is popular and is apparently capable of giving satisfactory yields of high-quality grain.

*Federation.*—This variety has for some years past held an important position in Marlborough, although it is now gradually losing favour.

*Jumbuck.*—In view of its reputation in the North Island and the need of a satisfactory wheat for spring sowing in the South, the use of Jumbuck has increased in the South Island during recent years.

*Nabawa and Ford.*—The possibilities of these two Australian varieties, introduced by Mr. A. Grant, Waimate, for spring sowing, were investigated.

*Tainui and Taiaroa.*—Formerly named S 617 and S 668 respectively, these two varieties, originating from Portugal, were selected by the Wheat Research Institute from a number of imported lines. They have shown much promise as spring-sown wheats in small-scale trials in Otago, and also in large-scale trials at Morven and Lincoln College in the 1934-35 season. Tainui is one of the earliest maturing varieties known in New Zealand.

*Lin Calel.*—This is a well-known wheat from the Argentine, where it ranges amongst those with highest grain quality. In

preliminary trials at the Pure Seed Station, Lincoln, it gave good results. It gives promise also of being a high-quality wheat, although, being a bearded variety, its appearance in the field is somewhat unattractive.

*Bencubbin.*—This variety from Western Australia is being grown in North Otago, and from reports obtained from farmers appears to prove satisfactory in that district.

*Cross 31.*—From the point of view of baking score and general agronomic characters the various lines of Cross 31 are similar to Solid Straw Tuscan. It was considered after preliminary trial, however, that the best lines would generally outyield Tuscan.

### METHOD OF CONDUCTING EXPERIMENTS.

Most of the trials were laid down in blocks with eight to ten replications of each variety. In others a modification of the "Beaven half-drill strip" method was employed, each variety being compared with adjacent control plots. The results were mostly examined statistically by the analysis of variance or by "students" method, except in Marlborough, where no facilities are available for threshing plots separately. A standard rate of seeding of 2 bushels per acre for each variety was generally adopted, and 1 cwt. of superphosphate was sown with the seed. Harvesting was usually carried out when the later-ripening varieties were in fit condition, although under some circumstances earlier-maturing varieties were cut with a scythe before the remainder. At harvest samples of each variety were collected and sent to the Wheat Research Institute for milling and baking tests.

### SUMMARY OF 1935–36 SEASON'S TRIALS.

Twelve trials were harvested in 1935–36, and the yields, together with remarks on the condition of varieties at harvest, are given in the tables and notes which follow :—

### A. *Marlborough Trials.*

Varieties compared : S.S. Tuscan, Cross 7, Marquis, and Federation (soft).

(1) *M. Walsh, Omaka.*—Date sown : 12th June, 1935. Date harvested : 6th January, 1936.

When cut Federation appeared to be the heaviest yielder, but differences were small. Birds had attacked all varieties to some extent, and the Federation in particular. Birds were troublesome when the crop was in stook and Federation suffered severely.

(2) *Smith Bros., Tua Marina.*—Date sown : 22nd August, 1935. Date harvested : 30th January, 1936.

When cut S.S. Tuscan had a very poor appearance, and had been heavily attacked by rust. Cross 7 was also showing rust to some extent.

*Table I.—Yields of Marlborough Trials, 1935 36.*

| Variety. | Omaka. | | Tua Marina. | |
|---|---|---|---|---|
| | Yield per Acre. | Increase over S.S. Tuscan. | Yield per Acre. | Increase over S.S. Tuscan. |
| | Bushels. | | Bushels. | |
| S.S. Tuscan .. .. | 34·4 | .. | 30·1 | .. |
| Cross 7 .. .. | 33·8 | −0·6 | 32·2 | 2·1 |
| Marquis .. .. | 30·6 | −3·8 | 39·3 | 9·2 |
| Federation .. .. | 29·9 | −4·5 | 36·7 | 6·6 |

Differences were not examined statistically.

## B. *Trials with Spring-sown Wheats.*

Varieties compared: S.S. Tuscan, Cross 7, Jumbuck, Nabawa, Ford, Tainui, and Taiaroa.

(3) *J. O. Redfern, Darfield.*—Date sown: 14th August, 1935. Date harvested: 21st January, 1936.

Some of the plots were damaged by weather, but sufficient were harvested for estimation of yield.

(4) *Mrs. C. Hall, St. Andrews.*—Date sown: 9th September, 1935. Date harvested: 12th March, 1936.

Plots were over-ripe, as cutting had been delayed by weather. Tainui suffered the most through not being cut at the right stage.

(5) *A. Grant, Waimate.*—Date sown: 16th September, 1935. Date harvested: 18th February, 1936.

In the early stages Jumbuck appeared poor, and did not appear to have tillered well. The grain of all varieties was badly sprouted through adverse weather conditions.

*Table II · Yield in Bushels per Acre of Spring-sown Trials, 1935 36.*

| Variety. | (3) Darfield. | | (4) St. Andrews. | | (5) Waimate. | |
|---|---|---|---|---|---|---|
| | Yield. | Increase over S.S. Tuscan. | Yield. | Increase over S.S. Tuscan. | Yield. | Increase over S.S. Tuscan. |
| S.S. Tuscan .. | 33·4 | .. | 24·1 | .. | 22·2 | .. |
| Cross 7 .. .. | 31·5 | −1·9 N.S. | 25·5 | 1·4 N.S. | 26·5 | 4·3 S. |
| Jumbuck .. | 32·2 | −1·2 N.S. | 17·8 | −6·3 S. | 24·8 | 2·6 N.S. |
| Nabawa .. .. | 33·3 | −0·1 N.S. | 27·0 | 2·9 S | 29·7 | 7·5 S. |
| Ford .. .. | 33·8 | 0·4 N.S. | 29·6 | 5·5 S. | 27·8 | 5·6 S. |
| Tainui .. .. | 45·4 | 12·0 S | 29·6 | 5·5 S. | 39·0 | 16·8 S. |
| Taiaroa .. .. | 42·4 | 9·0 S. | 36·4 | 12·3 S. | 29·7 | 7·5 S. |

In this and the tables which follow S. denotes significant difference and N.S. difference not significant.

## C *Trials with Lines of Cross 31.*

Varieties compared: S.S. Tuscan, six lines of Cross 31. (Cross 7 was included in the Lincoln College trial.)

(6) *R. and P. Campbell, Kingsdown.*—Date sown: 1st August, 1935. Date harvested: 10th February, 1936.

Prior to harvest the lines of Cross 31 did not appear to be as well grown as the Tuscan plots.

(7) *Lincoln College*.—Date sown: 30th April, 1935. Date harvested: 20th January, 1936.

The trial was carried out by the Wheat Research Institute, but results are included for comparison with trial 6.

*Table III.—Yield in Bushels per Acre of Lines of Cross 31 as compared with S.S. Tuscan, 1935–36*

| Variety. | (6) Kingsdown. | | (7) Lincoln. | |
|---|---|---|---|---|
| | Yield. | Increase over S.S. Tuscan. | Yield. | Increase over S.S. Tuscan. |
| S.S. Tuscan (mean) .. .. .. | 47·3 | .. | 66·6 | .. |
| Cross 31,01 .. .. .. | 46·4 | −0·3 N.S. | 75·3 | 4·7 S. |
| Cross 31,02 .. .. .. | 48·8 | 2·1 N.S | 75·1 | 7·9 S. |
| Cross 31,03 .. .. .. | 47·1 | −0·2 N.S. | 77·2 | 11·4 S. |
| Cross 31,04 .. .. .. | 46·8 | −0·5 N.S. | 75·6 | 8·4 S. |
| Cross 31,05 .. .. .. | 46·3 | −1·7 N.S. | 80·6 | 13·1 S |
| Cross 31,06 .. .. .. | 45·0 | −2·9 S. | 78·2 | 10·0 S. |
| Cross 7 .. .. .. | .. | .. | 74·1 | 3·6 S. |

## D. *Other Trials*.

Two experiments with selections of S.S. Tuscan were carried out, but did not show any superiority of the selections over commercial Tuscan. Four small-scale trials were sown in Otago and Southland, and the varieties included were S.S. Tuscan, Taiaroa, Jumbuck, Montana King, and Cross 7. The trials consisted of hand-sown plots protected by bird-netting. At harvest they were cut by hand, and the sheaves were forwarded to the Wheat Research Institute for threshing. The strike was a failure in one of the trials, and it had to be abandoned. Jumbuck gave distinctly poor returns in all three trials, while Montana King was only a little better. Cross 7 was poor at two centres, and was equal to Tuscan at the third. Taiaroa yielded as much as Tuscan at Greenfield and Benmore, and there was an indication that it yielded as much as Tuscan or possibly more at Winton, where, however, its straw was slightly tangled.

## SUMMARY OF 1936–37 SEASON'S TRIALS.

Twelve experiments were carried out by the Fields Division in 1936–37, and these included three small-scale trials in the North Island. Owing to excessive growth of wild tares, one experiment in the Ashburton district had to be abandoned. The yields and remarks on the varieties are as follows:—

## A. *Marlborough Trials*.

Varieties compared: Cross 7, Marquis, Tainui, Jumbuck, and Federation.

(1) *F. F. Mills, Grovetown*.—Date sown: 11th July, 1936. Date harvested: 15th January, 1937.

At time of cutting most of the varieties were down except Cross 7. Tainui was the first to ripen, followed by Marquis and Jumbuck, and then Cross 7.

(2) *I. Brown, Grovetown.*—Date sown: 8th July, 1936. Date harvested: 12th January, 1937.

Difficulty was experienced in harvesting all varieties except Cross 7, on account of lodging, and this was particularly so in the case of Marquis. Cross 7 was perfectly upright and showed no signs of lodging.

*Table IV.—Yields in Bushels per Acre in Marlborough Trials, 1936–37.*

| Variety. | (1) Grovetown. | | (2) Grovetown. | |
|---|---|---|---|---|
| | Yield. | Increase over Cross 7. | Yield. | Increase over Cross 7. |
| Cross 7 .. .. | 59·4 | .. | 49·2 | .. |
| Marquis .. .. | 60·9 | 1·5 | 54·7 | 5·5 |
| Tainui .. .. | 53·8 | −5·6 | 53·5 | 4·3 |
| Jumbuck .. .. | 59·1 | −0·3 | * | * |
| Federation .. .. | * | * | 55·3 | 6·1 |

* Not included.

B. *Trials with Cross 31.*

Varieties compared: S.S. Tuscan, Cross 7, Lin Calel, and Crosses 31,02, 31,03, and 31,05.

(3) *Mrs. C. Hall, St. Andrews.*—Date sown: 18th June, 1936. Date harvested: 16th February, 1937.

All plots were ripe when cut. Cross 7, Crosses 31,02 and 31,03, as well as Tuscan were slightly over-ripe, but no shedding of grain had taken place. Cross 31,05 had lodged badly, and S.S. Tuscan to some extent.

(4) *E. A. Payne, Amberley.*—Date sown: 28th May, 1936. Date harvested: 28th January, 1937.

No differences were observed between varieties at harvest; all were ripe.

*Table V.—Yields in Bushels per Acre in Trials with Crosses 31, 1936–37.*

| Variety. | (3) St. Andrews. | | (4) Amberley. | |
|---|---|---|---|---|
| | Yield. | Increase over S.S. Tuscan. | Yield. | Increase over S.S. Tuscan. |
| S.S. Tuscan .. .. | 34·3 | .. | 27·0 | .. |
| Cross 31,02 .. .. | 45·1 | 10·8 S. | 30·3 | 3·3 S. |
| Cross 31,03 .. .. | 46·6 | 12·3 S. | 29·8 | 2·8 N.S. |
| Cross 31,05 .. .. | 42·3 | 8·0 S. | 30·2 | 3·2 N.S. |
| Cross 7 .. .. | 39·0 | 4·7 N.S. | 30·1 | 3·1 N.S. |
| Lin Calel .. .. | 33·7 | −0·6 N.S. | 29·1 | 2·1 N.S. |

C. *Trials with "Spring" Wheats.*

Varieties compared: S.S. Tuscan, Cross 7, Lin Calel, Tainui, Jumbuck, and Bencubbin.

(5) *G. Warren, Darfield.*—Date sown: 12th August, 1936. Date harvested: 11th February, 1937.

Tainui and Jumbuck ripened earlier than the remainder, and were badly attacked by birds. Lin Calel, which is a bearded variety, was definitely not attacked.

(6) *G. Stevenson, Weston.*—Date sown: 25th August, 1936. Date harvested: 26th February, 1937.

At harvest S.S. Tuscan was slightly green, but sufficiently mature to cut. The remainder were ripe. Hessian fly had attacked Tainui, Jumbuck, Lin Calel, and Bencubbin, resulting in damage to the straw,

(7) *Manly Bros., Duntroon.*—Sown on 10th June, 1936. Jumbuck, Tainui, and Bencubbin were harvested on 13th January, 1937. Lin Calel, S.S. Tuscan, and Cross 7 were harvested on 1st February, 1937.

When cut Bencubbin had shaken rather badly, while Jumbuck and Tainui had also shed some grain.

*Table VI.—Yields of Varieties in Type C Trials, 1936–37 (Bushels per Acre).*

| Variety. | (5) Darfield. | | (6) Weston. | | (7) Duntroon. | |
|---|---|---|---|---|---|---|
| | Yield. | Increase over S.S. Tuscan. | Yield. | Increase over S.S. Tuscan. | Yield. | Increase over S.S. Tuscan. |
| S.S. Tuscan .. | 20·9 | .. | 20·6 | .. | 23·9 | .. |
| Cross 7 .. | 24·8 | 3·9 | 20·2 | −0·4 N.S. | 24·4 | 0·5 N.S. |
| Lin Calel .. | 29·7 | 8·8* | 19·2 | −1·4 N.S. | 21·9 | −2·0 N.S. |
| Tainui .. | 25·6 | 4·7† | 18·5 | −2·1 N.S. | 17·9 | −6·0 S. |
| Jumbuck .. | 16·4 | −4·5† | 14·2 | −6·4 S. | 17·4 | −6·5 S. |
| Bencubbin | .. | .. | 16·8 | −3·8 N.S. | 23·4 | −0·8 N.S. |

* Neglected by birds. † Badly attacked by birds.

## D. *Ecological and North Island Trials.*

A large ecological trial was sown on the farm of P. R. Talbot, Claremont, in which twenty-seven lines of Crosses 36 and 60 were tested on behalf of the Wheat Research Institute. It is not intended, however, to quote results in this report.

In the North Island small-scale trials comparing Jumbuck, Tainui, and Taiaroa were laid down at Feilding, Marton, and Colyton respectively. These plots were hand-sown, and at harvest cut by hand, the sheaves being forwarded to the Wheat Research Institute for threshing. Tainui was significantly better than Jumbuck at all centres, and was significantly higher in yield than Taiaroa at Marton and Colyton. Taiaroa outyielded Jumbuck significantly at Feilding.

## SUMMARY.

The main features of the two seasons' results given above are summarized below :—

(1) *Cross 7.*—In comparison with Solid Straw Tuscan, Cross 7 performed well during the two seasons under review. Although in Marlborough Cross 7 did not show up to the same advantage as it has done in previous seasons, and was in fact outyielded by Marquis in three out of four trials, in view of its earliness, excellent straw, and reliable yield, Cross 7 can still be recommended. During the past two seasons in Canterbury Cross 7 has never been outyielded by Tuscan, and was definitely superior in two trials. Its resistance to lodging, shorter straw, and earlier maturity have been valuable characteristics in view of the weather conditions experienced at harvest.

(2) *Tainui and Taiaroa.*—Both these varieties show good promise as spring wheats. Tainui appears particularly suitable for Canterbury, while Taiaroa is apparently more suited to South Otago conditions. A nucleus of seed of these varieties is being raised at the Pure Seed Station, and stocks will be ready for limited distribution for the sowing-season of 1938. In the meantime further trials with Tainui are contemplated in the North Island, where the possibilities of this variety are indicated especially in localities in which lodging as a rule is not severe.

(3) *Cross 31.*—As an alternative to Solid Straw Tuscan some of the lines of Cross 31 show distinct possibilities. Three of the lines of Cross 31 have performed well in both seasons in relation to Tuscan. At Lincoln in 1935–36 and St. Andrews in 1936–37 there was a wide margin in favour of the Crosses. Two of these lines, 31,02 and 31,05, have been retained for further trial.

(4) *Jumbuck.*—This variety has not shown to advantage in any of the trials. Owing to its early maturity, it has in some cases suffered from bird damage, which has been reflected in decreased yield.

(5) *Lin Calel.*—Both in autumn and spring sowings this variety has shown good promise, and out of five trials it was equal to Tuscan in four and superior in one, although in the latter there may have been differential damage by birds.

(6) *Other Varieties.*—Bencubbin has not shown any advantage over Tuscan in the two North Otago trials, although the prolonged drought during winter and spring probably favoured Tuscan and other later varieties. In Marlborough the variety known as "Federation" was inferior to Cross 7 in one trial and superior in two experiments, but in the two latter Marquis has also performed well. The yields from Marquis during the last few years' trials in Marlborough give further foundation to the popularity of this variety in the province. The two Australian varieties Nabawa and Ford gave good yields, but neither gave the same promise as Tainui as a satisfactory spring wheat for Canterbury conditions.

ACKNOWLEDGMENTS.

The Department extends its thanks to those farmers who provided land and facilities for carrying out the experiments. The field-work in the large-scale trials was carried out under the direction of Mr. R. McGillivray and Mr. J. M. Smith, Fields Superintendents at Christchurch and Dunedin respectively, by the following Instructors: H. de O. Chamberlain and D. R. Wilkie, Marlborough; A. V. Allo, Christchurch; C. C. Leitch, Timaru; T. Sellwood, Oamaru.

## INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published recently in the *New Zealand Patent Office Journal*, include the following of agricultural interest:—

No. 77980: Milking-machine; R. J. Daniell. No. 78007: Butter-pounding attachment; G. McHugh. No. 78017: Milking-machine; Aktiebolaget Separator. No. 78026: Casein-drying machine; Mullan and Foy. No. 78040: Animal drencher; W. Peirson. No. 78042; Ragwort-gun; J. Morice. No. 78044: Fertilizer-distributor; K. Burgess. No 78056: Grass-drying means; Kaloroil Burners, Ltd., and A. Goldberg. No. 78072: Milk-process; F. Jung. No. 78102: Honey-purification process; Cawthron Institute Trust Board. No. 78106: Drench-administering gun; Loudon Brothers, Ltd.

**Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price, 1s. prepaid.**

# EXPERIMENTS ON THE CONTROL OF TOMATO LEAF-MOULD.

E. E. CHAMBERLAIN and R. M. BRIEN, Plant Diseases Division, Plant Research Bureau, Department of Scientific and Industrial Research, and W. K. DALLAS and E. T. TAYLOR, Horticulture Division, Department of Agriculture.

LEAF-MOULD (*Cladosporium fulvum*) is, in New Zealand, the most troublesome and widely spread disease of glasshouse tomatoes. It was first recorded in the Dominion by Kirk in 1897. Chamberlain (1932) published an account of this disease, giving symptoms, economic significance, life history, and preventive measures. It was pointed out that the basis of any successful treatment must be the provision of adequate ventilation. It is not possible, however, under all conditions to provide sufficient ventilation to prevent leaf-mould from becoming established. In such circumstances it is the practice to apply therapeutants to help keep the disease in check. The present investigation was directed to the determination of the relative efficiency of those commonly recommended. In this article the results are recorded of three seasons' (1934–36) experiments. They were carried out at Lower Hutt, Wellington, in commercial glasshouses made available through the courtesy of the Hutt Valley Tomato-growers' Association.

## EXPERIMENTAL METHOD.

Experiment I (1934) was carried out in an unheated glasshouse where leaf-mould had previously occurred, and experiment II (1935) in a newly constructed unheated house. In the latter a high percentage of infection developed, and the same house was used in 1936 for experiment III.

Treatments were commenced when the plants were 12 in. to 18 in. high before the disease was observed on any plants. Applications were continued every eighteen to twenty-one days in experiments I and II, and at fourteen-day intervals in experiment III, until harvesting commenced, the plants then being 6 ft. to 7 ft. high.

In 1934 a bucket pump with cyclone nozzle was used for the first three applications, and knapsack sprayers with bordeaux nozzles for the fourth. The first two sprayings during 1935 were applied by means of a bucket pump and the last two with knapsacks, while in 1936 a bucket pump was used throughout. With the bucket pump it was possible to maintain a good pressure and provide a driving mist of fine particles. Only a low pressure (10 lb. to 15 lb.) could be secured with the knapsack sprayer, and this resulted in a coarse spray, having poor penetration. In all cases the operator endeavoured to secure a good spray coverage on both sides of the leaves. A noticeably better coverage was obtained with the bucket pump. In all experiments sprays were applied at a rate necessary for adequate cover, requiring half a gallon per row of thirteen to fourteen plants for the first treatment, and increasing with each application to 1 gallon per row for the final treatment.

Dusts were applied with a rotary hand-blower during 1934 and 1936, and with a small hand-duster in 1935. An attempt was made to secure a covering of dust particles on both the upper and lower leaf surfaces.

After leaf-mould infection was observed, counts were taken of the number of lesions on one leaf of each plant at approximately the same height. Further counts were made immediately before each subsequent application. Although this method of determining the relative amounts of infection occurring in the various treatments was not entirely satisfactory, the short time at our disposal did not permit of more comprehensive measurements.

The crops were visited only at the time of spraying, and the management of the glasshouses was left entirely in the hands of the growers. Under these circumstances there was no correlation between the spraying experiments and the more important means of control by ventilation.

## MATERIALS USED.

(1) *Ground Sulphur (Flour Sulphur)*.—The particle size varies considerably according to the grade of sample, ranging from a minimum of about 4 μ to a maximum of 250 μ. It was employed as a dust both alone and in combination with gas-sulphur.

(2) *Sublimed Sulphur (Flowers of Sulphur)*.—This material consists of particles varying from 8 μ to 30 μ aggregated into groups, sometimes attaining a size of 400 μ. The aggregates do not break up when applied to the plants. Sublimed sulphur was used as a dust only.

(3) *Gas-sulphur*.—The particle size ranges from 2 μ to 10 μ with an average of about 5 μ. In these experiments one product of this type was used as a spray and two others as dusts, one of the latter being in combination with ground sulphur.

(4) *Colloidal Sulphur*.—Sulphur in a very fine state of subdivision, the majority of particles being 0·1 μ to 0·5 μ. Colloidal sulphurs are available in the form of pastes containing 40 per cent. to 50 per cent. of sulphur. They also contain a colloid which acts as a dissociant and a suspensor.

(5) *Lime-sulphur*.—The active constituent of lime-sulphur is a mixture of polysulphides of calcium. The polysulphide content of the products used was 18 per cent. in experiment I and 15 per cent. in experiments II and III.

(6) "*Shirlan A.G.*"—A proprietary product composed of 25 per cent. salicylanilide, 10 per cent. of a wetting-agent ("Agral"), and 65 per cent. water. The salicylanilide, which is the active constituent, has a particle size of 0·5 μ to 12 μ, the majority of particles being 1 μ to 2 μ.

(7) "*Agral.*"—This is a proprietary organic wetting-agent.

## EXPERIMENT I (1934).

Treatments were carried out on the following varieties: "Britain's Best," 7 rows; "Salad Gem," 46 rows; "Marvel," 18 rows; and

"Kondine Red," 9 rows. Sprays applied were as follows: "Shirlan A.G.," 0·3 per cent.; colloidal sulphur, 0·2 per cent.; gas-sulphur, 0·2 per cent.: lime-sulphur, 0·083 per cent.*; lime-sulphur, 0·083 per cent., plus colloidal sulphur, 0·2 per cent. Sublimed sulphur was used as a dust. Untreated control plots were left between each set of six treatments. The first application was made on September 26th, and subsequent applications on October 16th and November 1st and 19th.

*Results.*—Leaf-mould was first observed on October 16th, 1934, infection being confined to occasional leaves on scattered plants. On November 1st counts were taken and these showed that "Shirlan A.G.," lime-sulphur, lime-sulphur plus colloidal sulphur, and sublimed sulphur all gave some measure of control. Colloidal sulphur and gas-sulphur did not reduce infection, while lime-sulphur plus colloidal sulphur had no advantage over lime-sulphur alone.

The plants were again examined on November 19th and December 7th, but leaf-mould infection was so severe that no counts were taken. Observations showed that there was a slight reduction in incidence of infection on plants treated with "Shirlan A.G.," lime-sulphur, lime-sulphur plus colloidal sulphur, and sublimed sulphur, but the other treatments had no apparent effect on the disease.

## Experiment II (1935).

The varieties treated were "Early Market," 39 rows, and "Peter's Special," 27 rows. The treatments carried out were as follows: "Shirlan A.G." 0·3 per cent., colloidal sulphur 0·2 per cent., lime-sulphur 0·083 per cent., lime-sulphur 0·083 per cent. plus colloidal sulphur 0·2 per cent. as sprays; and sublimed sulphur and gas-sulphur as dusts. Applications were made on October 8th and 25th and November 12th and 29th.

*Results.*—Leaf-mould was first observed on November 12th, 1935, when occasional lesions were found on plants scattered throughout the house. During the next two visits counts were taken, the results of which are given in Table I. They show that "Shirlan A.G.," lime-sulphur, lime-sulphur plus colloidal sulphur, and sublimed sulphur all brought about some reduction in amount of infection. Lime-sulphur plus colloidal sulphur appears to have been slightly more effective than the others, and sublimed sulphur slightly less so. Colloidal sulphur alone and gas-sulphur dust had little effect on the disease.

A final inspection of the plants was made on December 20th, 1935, and all plants found to be heavily infected. From observations it

* Lime-sulphur 0·083 per cent. and 0·1 per cent. refers to the percentage of polysulphide. Thus—

Lime-sulphur 0·083 per cent. = 1–216 for a lime-sulphur of 18 per cent. polysulphide content, and 1–180 for a lime-sulphur of 15 per cent. polysulphide content.

Lime-sulphur 0·1 per cent. = 1–180 for a lime-sulphur of 18 per cent. polysulphide content, and 1–150 for a lime-sulphur of 15 per cent. polysulphide content.

appeared that in the case of the variety "Early Market" "Shirlan A.G." was the only treatment which had had any beneficial effect on the plants. Plants treated with this material not only appeared to show less leaf-mould, but also less of a physiological scorch which was present on leaves of plants in all other treatments and controls. In the case of the variety "Peter's Special," plants treated with "Shirlan

*Table I.—Results of Experiment II, 1935.*

| Treatment.* | Percentage. | Number of Rows. | Average Number of Lesions per Row. Nov. 12th, 1935. | Nov. 28th, 1935. |
|---|---|---|---|---|
| VARIETY "EARLY MARKET," THIRTEEN PLANTS PER ROW. | | | | |
| Check | .. | 2 | 25 | 74 |
| Colloidal sulphur | 0·2 | 2 | 32 | 65 |
| Gas-sulphur | Dust | 2 | 25 | 72 |
| Sublimed sulphur | Dust | 2 | 23 | 75 |
| "Shirlan A.G." | 0·3 | 2 | 39 | 40 |
| Check | .. | 2 | 81 | 173 |
| Lime-sulphur + Colloidal sulphur | 0·083 + 0·2 | 2 | 38 | 70 |
| Lime-sulphur | 0·083 | 2 | 32 | 143 |
| "Shirlan A.G." | 0·3 | 2 | 23 | 73 |
| Gas-sulphur | Dust | 2 | 29 | 98 |
| Check | .. | 2 | 22 | 144 |
| Sublimed sulphur | Dust | 2 | 16 | 51 |
| Colloidal sulphur | 0·2 | 2 | 17 | 85 |
| Lime-sulphur + Colloidal sulphur | 0·083 + 0·2 | 2 | 17 | 32 |
| Lime-sulphur | 0·083 | 2 | 34 | 53 |
| Check | .. | 3 | 39 | 94 |
| Lime-sulphur | 0·083 | 3 | 22 | 55 |
| Check | .. | 3 | 30 | 77 |
| VARIETY "PETER'S SPECIAL," THIRTEEN PLANTS PER ROW. | | | | |
| Sublimed sulphur | Dust | 3 | 3 | 49 |
| Check | .. | 3 | 10 | 79 |
| Gas-sulphur | Dust | 4 | 17 | 95 |
| "Shirlan A.G." | 0·3 | 4 | 18 | 59 |
| Lime-sulphur | 0·083 | 4 | 16 | 85 |
| Check | .. | 3 | 23 | 127 |
| Colloidal sulphur | 0·2 | 3 | 18 | 88 |
| Lime-sulphur + Colloidal sulphur | 0·083 + 0·2 | 3 | 12 | 35 |

* The order of the treatments as listed in both tables represents their relative positions in the glass-house.

A.G.," lime-sulphur, and lime-sulphur plus colloidal sulphur were slightly healthier in appearance than those of the controls or of the other treatments.

Plants treated with gas-sulphur were showing noticeable leaf injury* when examined on November 12th, and this was still apparent on November 28th.

* This injury was probably induced by impurities often present in this product.

*Table II.—Results of Experiment III, 1936.*

| Treatment. | Percentage. | Number of Rows. | Average Number of Lesions per Row. | | |
|---|---|---|---|---|---|
| | | | Nov. 13th, 1936. | Nov. 27th, 1936. | Dec. 11th, 1936. |
| VARIETY "EARLY MARKET," FOURTEEN PLANTS PER ROW. | | | | | |
| *West Side of Glasshouse.* | | | | | |
| Check .. .. | .. | 1 | 15 | 120 | 87 |
| Lime-sulphur .. | 0·1 | 2 | 6 | 13 | 36 |
| Lime-sulphur .. + "Agral" .. .. | 0·083 + 0·1 | 2 | 0·5 | 5 | 6 |
| Check .. .. | .. | 2 | 12 | 16 | 14 |
| Lime-sulphur .. | 0·083 | 2 | 2·5 | 8 | 13 |
| Sublimed sulphur .. | Dust | 2 | 10 | 20 | 13 |
| Check .. .. | .. | 2 | 8 | 5 | 8 |
| Gas-sulphur .. + Ground sulphur .. | 20 + 80 Dust | 2 | 11 | 16 | 19 |
| "Shirlan A.G." .. | 0·47 | 2 | 2·5 | 1 | 7 |
| Check .. .. | .. | 2 | 13 | 25 | 52 |
| "Shirlan A.G." .. | 0·23 | 2 | 3 | 3 | 2 |
| Lime-sulphur .. | 0·1 | 2 | 1·5 | 8 | 15 |
| Check .. .. | .. | 2 | 20 | 19 | 52 |
| "Shirlan A.G." .. | 0·47 | 2 | 7 | 17 | 33 |
| Lime-sulphur .. | 0·083 | 2 | 9 | 19 | 50 |
| Check .. .. | .. | 2 | 30 | 44 | 129 |
| Ground sulphur .. | Dust | 2 | 30 | 34 | 93 |
| Check .. .. | .. | 1 | 22 | 52 | 88 |
| *East Side of Glasshouse.* | | | | | |
| Check .. .. | .. | 1 | 18 | 42 | 42 |
| Sublimed sulphur .. | Dust | 2 | 14 | 10 | 18 |
| Ground sulphur .. | Dust | 2 | 10 | 3 | 4 |
| Check .. .. | .. | 2 | 10 | 16 | 9 |
| "Shirlan A.G." .. | 0·23 | 2 | 1·5 | 3 | 0 |
| "Shirlan A.G." .. | 0·47 | 2 | 0·5 | 1 | 0·5 |
| Check .. .. | .. | 2 | 3 | 9 | 13 |
| Lime-sulphur .. | 0·083 | 2 | 4 | 3 | 18 |
| Lime-sulphur .. | 0·1 | 2 | 3 | 10 | 13 |
| Check .. .. | .. | 2 | 16 | 46 | 28 |
| Lime-sulphur .. + "Agral" .. .. | 0·083 + 0·1 | 2 | 6 | 6 | 6 |
| Sublimed sulphur .. | Dust | 2 | 1·5 | 4 | 13 |
| Check .. .. | .. | 2 | 31 | 37 | 35 |
| Gas-sulphur .. + Ground sulphur .. | 20 + 80 Dust | 2 | 16 | 18 | 25 |
| "Shirlan A.G." .. | 0·23 | 2 | 1 | 3 | 1·5 |
| Check .. .. | .. | 2 | 16 | 31 | 31 |
| "Shirlan A.G." .. | 0·47 | 2 | 4 | 3 | 3 |
| Check .. .. | .. | 1 | 32 | 70 | 97 |

## EXPERIMENT III (1936).

Only one variety—Early Market—was treated. The fungicides applied were—"Shirlan A.G." 0·23 per cent., "Shirlan A.G." 0·47 per cent., lime-sulphur 0·1 per cent., lime-sulphur 0·083 per cent., and lime-sulphur 0·083 per cent. plus "Agral" 0·1 per cent., as sprays; and sublimed sulphur, ground sulphur, and gas-sulphur 20 per cent. plus ground sulphur 80 per cent. as dusts. Applications were made at fourteen-day intervals from October 2nd to November 27th.

*Results.*—The crop, when examined on October 16th and 30th, showed only a trace of leaf-mould. Counts were taken on November 13th and 27th and on December 11th. Results, given in Table II, show that all treatments gave some control, although in the case of gas-sulphur plus ground sulphur it was slight. "Shirlan A.G." at either strength appears to have given the best and most consistent results, although only slightly more effective that lime-sulphur plus "Agral." The dust treatments were not as efficient as the sprays. None of the treatments caused injury to the plants.

TOMATO LEAF-MOULD, SHOWING THE PURPLISH-BROWN VELVETY LESIONS WITH WHITE MARGINS ON UNDERSIDE OF LEAF. [*Photo by H. Drake.*

## RECOMMENDATIONS.

No treatment has yet been evolved to give satisfactory control of leaf-mould, unless accompanied by some regulation of the humidity of the glasshouse. Therefore the application of therapeutants cannot be used as a substitute for adequate ventilation.

Of the materials tested in the foregoing experiments, "Shirlan A.G." gave the most consistent results. It is recommended at a concentration of 0·3 per cent. (3 lb. to 100 gallons). Applications should be made with a pressure-pump (60 lb. pressure), and a good spray coverage obtained on both sides of the leaves.

### SUMMARY.

(1) The paper covers three years' experiments on the control of tomato leaf-mould (*Cladosporium fulvum*) by the use of therapeutants.

(2) It is shown that where conditions are favourable for its development leaf-mould cannot be successfully controlled by any of the materials tested.

(3) The following is the approximate order of merit of the therapeutants used: "Shirlan A.G.," lime-sulphur plus "Agral," lime-sulphur plus colloidal sulphur, lime-sulphur, sublimed sulphur, ground sulphur, colloidal sulphur, gas-sulphur plus ground sulphur, gas-sulphur spray, and gas-sulphur dust. Of these, the first four proved sufficiently effective to warrant their use.

(4) Under the conditions of the experiments, gas-sulphur dust alone caused foliage injury.

(5) "Shirlan A.G." spray at a concentration of 0·3 per cent. gave consistently the best control of leaf-mould.



### ACKNOWLEDGMENT.

We desire to record our appreciation to Messrs. Cooksley and Feretti for the use of their glasshouses, plants, and assistance given by staff, and also to the Hutt Valley Tomato-growers' Association for procuring the use of these houses for the experiments.


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## A HISTORY OF THE NEW ZEALAND DAIRY INDUSTRY.

IN this book, for the first time, the principal historic details of the development of New Zealand's great dairying industry have been gathered together, the more important headings being the work of the pioneers, the founding of the dairy factories, refrigeration as applied to the dairy industry, the spread of co-operation, the establishment of the export trade, the grading system, the introduction of home-separation, the importation of dairy cattle, and legislation.

In the twenty-one chapters which comprise the four hundred pages of this work every important phase of New Zealand's dairying industry has been dealt with, while the period covered is from colonization (1840) to the end of 1935, with a supplementary summary relating to 1936. In all, some 170 dairy factories and over 300 persons are mentioned. The book is profusely illustrated, there being thirty-eight pages of illustrations comprising sixty-six pictures of personalities, dairy factories old and new, dairy stock, and general subjects. Many of the pictures appear for the first time.

A statistical appendix includes many tables not previously compiled, and presents a complete statistical survey from the earliest recorded figures to the present day.

The author of the book is Mr. H. G. Philpott, of the Dairy Division, Department of Agriculture. Mr. G. M. Valentine, Assistant Director of the Dairy Division, contributed a chapter on "Dairy Machinery and Appliances," while there is a foreword by the Hon. W. Lee Martin, Minister of Agriculture, and a preface by Mr. W. M. Singleton, Director of the Dairy Division

The book is being made available to purchasers at cost of publication, namely 15s. per copy, or 15s. 8d. post free. [N.B.—Cheques must bear exchange.]

Copies may be had from The Director-General, Department of Agriculture, Private Bag, Wellington.

# MOULD PENETRATION IN NEW ZEALAND CHEESE.

G. M VALENTINE, Assistant Director, Dairy Division, Wellington.

THE development of mould on the rinds of cheese during ripening is a natural process unless special care is taken to prevent it, and mould penetration probably has been known as long as cheese has been made. Complaints regarding this defect have been received from London from time to time ever since the export of cheese commenced, but they seem to have been increasingly frequent during recent years, and particularly during the 1935-36 season.

During the period from 17th December, 1935, till 21st December, 1936, forty-seven special reports on mould penetration were received from the London officers of the Dairy Division. These represented cases in which complaints were received by them from importers, wholesalers, and retailers, and in most instances referred to mould seams which were found in the interior of the cheese when cut for sale.

In view of the quantity of cheese shipped during that period, totalling 84,494 tons, the number of complaints received was comparatively small, but it can be accepted that they did not cover all cases of mould penetration. As the defects were a source of annoyance to users and a loss of good will to New Zealand, they cannot be treated lightly, and steps must be taken to reduce them as much as possible.

The forty-seven complaints were spread over thirty-one factories as follows: Cheese from one factory was complained of on six separate occasions, one three times, nine on two occasions, and twenty once.

The various grading-stores were affected as follows: Bluff, nineteen complaints in respect of the cheese from nine factories; Wellington, seven from four; Patea, six from five; New Plymouth, five from five; Wanganui, four from two; Dunedin, three from three; Auckland, two from two; and Lyttelton, one from one.

There is no means of determining the aggregate amount of cheese affected, but the reports received seldom had any reference to more than one or two crates, and allowances for a few pounds of waste cheese. Some, however, concerned fairly large parcels, as follows: "2½ cwt. returned to warehouse"; "40 lb. lost"; "161 lb. loss on 140 crates"; "80 lb. to 90 lb. waste plus £5 allowance made"; "loss of 340 lb. on 34 crates."

## LONDON REPORTS.

In most of the reports an attempt had been made to indicate the possible cause of the mould penetration, and this is dealt with by Mr. F. H. Taylor, Inspector of New Zealand Dairy Products, London, in a letter dated October, 1935, which reads in part as follows:—

> "During the past week I visited Messrs. ——'s store in London to investigate a complaint regarding mould in cheese. At the time of my visit these people had cut some three crates of cheese and from these six cheese approximately 20 lb. of pieces were laid aside as being unsuitable for their counter trade. On examination it was noticed that in some instances the mould penetration had

started fairly well down the wall, and some cracks were noticed in the rinds which would indicate that the cheese had been damaged at some stage.

"There seem to me to be two possible explanations for the frequent occurrence of this mould penetration. Firstly, I have noticed that in nearly all cases where this trouble has occurred it has been found on examination that the rims are very small. This would seem to indicate that if the cheese are made in the old type of hoop there does not seem to be sufficient curd to allow for the correct amount of pressure, and this probably causes looseness. The second explanation might be that the cheese are being damaged prior to being put into the crates. The examination of this particular cheese would seem to indicate that the walls had been bumped on a sharp corner, possibly on the shelf during turning. I can see no other reason for the cheese developing this trouble. There is the old explanation of the faulty mixing of the cold curd, but an examination of a number of these cheese would lead one to suppose that this was not the cause of the trouble, as the cheese on either side of the mould seam showed that the curd was the same and had knitted thoroughly prior to the development of the mould. I think we shall have to look to the curing-room for the explanation of the greater percentage of this trouble.

"Judging by some of the cheese which I have seen displayed in various retail grocers' shops, I am sure that we are not hearing all that could be said about this complaint. Numbers of pieces of cheese which I have seen have shown mould penetration to a greater or lesser degree, but unless they are very badly affected, or involve some considerable loss, nothing is said about the matter.

"By way of comment, it is interesting to note that Cheshire cheese which has developed this defect appears to sell at a premium. I have seen several of these displayed in shop-windows and marked as "Blue Cheshires." For some reason these are considered to be something of a luxury, whereas the slightest defect of this sort in Cheddars leads to complaints, and retail counter assistants state that they are difficult to dispose of."

Complaints received during the period mentioned have been grouped under the following headings:—

| | |
|---|---|
| Cracked rinds .. .. .. .. .. | 14 |
| Cracked crowns .. .. .. .. | 11 |
| Cracks under rims .. .. .. .. | 8 |
| Mould seams (2 tops, 2 bottoms) .. .. | 4 |
| Loose crowns .. .. .. .. .. | 5 |
| Loose bottoms .. .. .. .. | 4 |
| Mould seams in close cheese .. .. .. | 3 |
| Cracked rims, ends, sides, and generally in bad condition .. .. .. .. .. | 7 |

### CAUSES OF FAULTS.

Suggestions as to the possible cause of these faults were also made as follows:—

"Faulty crowns—curd not knitted"; "rims and walls cracked suggests cold curd"; "bad rinds and crowns—not properly

pressed." These seem to indicate either that the hoops have not been filled full enough or that the pressure on the presses had not been maintained.

"Cracked rinds" suggests lack of scalding, or cheese being in a draught or acidy, while the number of complaints of cracked crowns seems to indicate that curd has been added at dressing to build up the cheese. This method of "sizing" was actually suggested at one meeting of managers, although the more general method followed is to over-fill the hoops and cut the cheese down at dressing.

Cracks under the edges would suggest that the rim is the cause of this defect if it were not for the fact that the detached ends are not confined to the top of the cheese. They are probably the starting-point for the mould seams and the loose tops and bottoms complained of, the last two being a later stage of development of the first. It is not difficult to understand how mould which has gained access through cracks in the rim to the concave lines of slits which show across all open cheeses from top to bottom when cut in half should develop rapidly when the crown is detached from the rest of the cheese. But it is difficult to understand the detachment of an almost similar concave piece from the bottom of the cheese where these lines are almost straight, unless it be due to "huffing."

The following quotations give a possible explanation: "Loose bottom—cracked side"; "fracture one third distance up—probably jarred when green." The necessity for careful handling of the cheeses while in a green state cannot be too much stressed, as any one who has examined cheese with cracked rims is immediately impressed with the feeling that rough handling was the probable cause. This would at once suggest that defects of this class would be more common in cheese which is transported to a central curing-room while in a green condition, but a survey of the complaints received shows that only one referred to cheese handled in this way.

More difficult still is it to understand the growth of mould in close cheese free from slits: "Close cutting, but slightly moulded"; "small crack, mould vein right across cheese, close cheese with no mechanical or slitty openings—suggest mould contamination before hooping." It is accepted that mould cannot grow except in the presence of air, and the above suggests that the amount needed is very small.

### Contamination from Clothing.

Mould or mould spores are present in all cheese-factories to a greater or lesser extent, but heavy contamination from the clothes of employees who have been working in the curing-room (some of which contain stocks of cheese for local sale which are heavily coated with mould) and at a later period take part in handling the curd in the vats has been suggested as a probable cause of contamination.

Cheese in bad condition at all points may be due to many causes from the making process up to final disposal, as there are quite a number of probable reasons for the development of cracks in the skin of a poorly made cheese, more especially when it is held in a poor curing-room. A survey of the curing-rooms at those factories about which a number of complaints were received has shown that most of them were poorly ventilated, and in such a condition that the growth of mould was encouraged. Extracts from reports read as follows :—

(*a*) " Previous to this curing - room being ventilated it was regarded as a very damp room, and doubtless the position in previous years was aggravated somewhat by the storage of local-market cheese, which invariably become mouldy."

(*b*) " With reference to this curing-room it is now receiving attention, and with the extra ventilation provided should assist in preventing excessive mould growth. It has always been recognized to be a very damp one."

(*c*) " This curing-room has always shown excess mould development, and the manager has undertaken to provide more ventilation."

Later—" It is now adequately ventilated and freer from mould than at any time previously."

(*d*) " This room was ventilated during the winter months, and is this year much freer from mould."

It would be unsound to attribute all cases of mould penetration to the condition of the curing-room, as it is true of both cool stores and ships that, while some are practically free from mould, others are the reverse. It can be claimed, however, that the curing-room should be so constructed and controlled that the possibility of contamination, even of cheese with defective rinds, will be reduced to a minimum.

## Access of Air.

During investigations which he carried out during 1929–31 into the question of discoloration in New Zealand cheese, Mr. G. F. V. Morgan, at that time bacteriologist to the Division, showed that all cases of mould penetration were connected with a break in the rind of the cheese, which allowed the access of air. During the 1931–32 season a very large number of reports were received from London on the prevalence of discoloration in New Zealand cheese, and Mr. Morgan formed the opinion that mould penetration was probably the cause of, or had a connection with, the discoloration. Because of this belief instructions were at that time issued to all cheese instructors to pay particular attention to the finish of the cheese and the care of the curing-rooms at all factories, and these matters have since received close attention.

On 13th January, 1936, a circular letter was sent to all cheese-factory managers drawing attention to the number of complaints being received regarding mould penetration, and stressing the need

for care in handling the cheese, and proper mixing of curd carried over from one day with the following day's make before dipping.

As complaints continued to come forward from London, the question was referred to the Acting Director of the Dairy Research Institute, who suggested that the loose crowns and bottoms were possibly due to gas produced by lacto-bacilli in open cheese, and raised the question as to whether mould penetration occurred in close cheese. It was further suggested that, if the above theory was correct, the cure lay in making close cheese, and that the problem was therefore the same one as openness in general.

The question whether mould penetration was found in close cheese was referred to Mr. Taylor, and it will be noted that it is really answered by the instances already quoted in which close cheese was affected.

Under date of 23rd October, Mr. Taylor replied to this letter, and the following is a summary :—

> " Mould seams are found in both open and close cheese. Openness will make it easier for mould to spread. Cheese appeared to have huffed up at some time and allowed mould to develop in the seam. More complaints from Southland than other provinces."

It should be stated that as the result of his observations in England Mr. Robertson considers the huffing theory to be worth further investigation.

On the same date a circular letter was sent to all graders-in-charge and cheese instructors asking the former to report on the methods of handling at cool stores, and the latter to pay special attention to the handling in the factories.

### Handling of Crates.

A survey of the replies received from the grading ports did not disclose any marked difference in the methods of handling. If there are any weak spots, they are more or less common to all. They are—Dropping of the third tier of crates which are lying on their sides in the railway-truck when starting to unload, and dropping the top tiers in the cool stores, which are up to six high, when breaking out a straight face in a stack when loading out. The latter seems to be the weakest spot in the chain of handling in New Zealand.

Special conditions obtain at some ports regarding shipment. Patea cheese is transhipped in Wellington, either from coastal steamer to Home steamer or from coastal steamer to Harbour Board store, and thence to Home steamer. Shipments of cheese from the Bluff during 1936 totalled 33, Wellington 81, Patea 68, New Plymouth 45, Wanganui 36, Dunedin 24, Auckland 66, and Lyttelton 24. Cheese in the Bluff cool stores would therefore have a long storage period before shipment, the crates being on the same end without turning during that time, and it has been suggested that this treatment might encourage huffing, but Wellington, which is next for the number of complaints, has the most frequent shipments. It has also been noticed that practically all the cheese about which complaints of mould penetration were received at the Bluff were waxed.

In connection with Auckland, it is perhaps worth noting that the greater portion of the cheese shipped from that port is made in factories in which the temperature of the curing-rooms is controlled by artificial refrigeration.

Points covered by instructors regarding possible causes of mould penetration deal with the need for close rinds, and mention the following points: Space not covered between bandage and cap; loose bandages caused by not pulling them up at dressing; handling of green cheese.

### Time of Dressing.

A point was also raised regarding the dressing of cheese in the morning instead of the evening. This practice is said to have increased recently in order to avoid paying overtime, with the result that owing to scalding water not being available at the time when the work is being done in the morning, and the short period of pressing after it is finished, no proper rind is developed on the crown. As the general practice is to "size" or cut down the cheese at this stage the cap and bandage do not adhere to the crown, and cracking and mould penetration results.

The Dairy Research Institute could not conveniently undertake any experimental work on this subject at this stage, and with a view to getting some further information on the question of the effect of the treatment which the cheese receives during handling it was decided to take advantage of Mr. Robertson's return from London, and arrangements were made for this to be done at New Plymouth during September, 1936. The suggestion was that five crates of open cheese and five of close cheese should be purchased and put through various treatments, and be examined by cutting each cheese into two halves some months later.

Some of Mr. Robertson's comments when the suggested scheme was put before him were as follows:—

> "The amount and nature of the handling no doubt plays an important part in inducing mould-growth, but mould penetration in cheese seen in London, whether in English, Canadian, or New Zealand, was by no means confined to open cheese.
>
> "There are several types, the most common being that which gains access through cracks in the end of the cheese. Then there is the type caused by the end lifting off, and this is seen as often at the bottom as at the top of the cheese."

The ten crates of experimental cheese were received at Moturoa grading stores on 13th October, and during November a single cheese, which was received there with a crack round the lip, was purchased, as it bore indications that the end would lift off.

Commenting on this cheese, Mr. Robertson says, "Many close cheese will puff up, and the only sign of defective body is seen where the break takes place. On the other hand, many cheese with split texture also puff up, so there may be some connection between the two. The whole trouble arises when the fracture extends to the rind and allows the admission of air, as without this no mould development can take place. From what was seen in Great Britain I would not say that open cheese were any more liable to this particular defect than close cheese."

The following details give the treatment to which the cheese were subjected, and the results:—

### Experiment to determine the Influence of Handling on Mould Penetration in Cheese.

Ten white cheese were purchased from a dairy company which was making close cheese. Cheese made 12th October, 1936.

Ten coloured cheese were purchased from a dairy company which was making open cheese. Cheese made 12th October, 1936.

Cheese were received at the grading-works, Moturoa, on 13th October, 1936; packed, 29th October, 1936; stacked on ends till 10th December, 1936; stacked on sides till 18th February, 1937.

Examined at Wellington, 19th April, 1937. Age approximately six months.

One cheese with a cracked lip was purchased from another dairy company on 15th November.

All cheese was forwarded to Wellington by rail on 18th February and received on 22nd February. Stacked on ends till 19th April, 1937. Treatment of cheese was as follows: Turned daily until crating on 29th October. Crates 1, 3, 5, and 7, cheese packed with bottoms to centre board; crates 2, 4, 6, 8, and 10, cheese packed with tops to centre boards.

| Marks. | Treatment on Shelves and during Packing. | Treatment of Crates. | Remarks. |
|---|---|---|---|
| **Group 1: Crates 1 and 2—** | | | |
| Crate 1—Cheeses No. 1 white and No. 1 coloured<br>Crate 2—Cheeses No. 2 white and No. 2 coloured | Handled carefully at all stages. | Crates stacked on end for six weeks without turning and a further ten weeks on sides | 1W No visible fractures in rind<br>1C Cracked ends, one over 1 in. deep<br>2W Sound rind.<br>2C Cracks on sides. |
| Cheese No. 2 (coloured) showed a bare patch when received due to inefficient dressing | | | |
| **Group 2: Crates 3 and 4—** | | | |
| Crate 3—Cheeses No. 3 white and No. 3 coloured<br>Crate 4—Cheeses No. 4 white and No. 4 coloured | Handled carefully up till crating, and then treated roughly by letting crates fall to floor | Crates stacked on end for six weeks without turning, and a further ten weeks on sides | 3W Cracks on sides.<br>3C Small cracks on sides<br>4W Good sound rinds.<br>4C Fracture in end. |
| Cheese No. 4 (coloured) had a nail puncture and also a loose cap when received | | | |
| **Group 3: Crates 5 and 6—** | | | |
| Crate 5—Cheeses No. 5 white and No. 5 coloured<br>Crate 6—Cheeses No. 6 white and No. 6 coloured | Handled carefully at all stages. | Crates stacked on end and turned carefully each week for six weeks, then stacked on sides for a further ten weeks | 5W Good rinds<br>5C Good rinds<br>6W Small cracks in sides<br>6C Small cracks in sides. |

EXPERIMENT TO DETERMINE THE INFLUENCE OF HANDLING ON MOULD PENETRATION IN CHEESE—*continued*.

| Marks. | Treatment on Shelves and during Packing. | Treatment of Crates. | Remarks. |
|---|---|---|---|
| Group 4 : Crates 7 and 8—<br>Crate 7—Cheeses No 7 white and No. 7 coloured<br>Crate 8—Cheeses No. 8 white and No. 8 coloured | Handled roughly during turning, and dropped on ends on shelves | Crates stacked on end and turned roughly each week for six weeks, then stacked on sides for a further ten weeks | 7W Closer than previous lots; very fine cracks in sides.<br>7C Closer than previous lots; very fine cracks in sides; nail in lip.<br>8W Closer than 7W; long fracture in lip, apparently a cut.<br>8C Closer than 7C; very small cracks in sides. |
| Group 5: Crates 9 and 10—<br>Crate 9—Cheeses No. 9 white and No. 9 coloured<br>Crate 10—Cheeses No. 10 white and No. 10 coloured | Handled roughly and treated similarly to 7 and 8<br>Treated as above and dropped on floor from height of 3 ft. | Crates dropped to floor from one tier high, stacked on end for six weeks without turning, then ten weeks on sides | 9W Similar to 7W.<br>9C Closer than 7C; sound ends and sides.<br>10W Closest cheese of whole experiment; number of large cracks in rinds.<br>10C Some large cracks in rinds and lip, with a strong growth of mould for a short depth only. |

Crate with one cheese with cracked lip: Large number of mechanical openings; bottom more open than top; loose top but not completely detached from rind; large fracture in lip, break in rind on side; no mould penetration.

## General Observations.

There was practically no mould development on the rinds. The bottom halves of all the cheese were more open than the top halves, more particularly in the white cheese.

Ends next to centre boards were in all cases softer than the opposite end, whether the cheeses were resting on the centre board or not during the period in stacks.

Grading-points of all cheese white and coloured :—

White—Flavour, 40½ ; body, 18 ; closeness, 18½ : total 92.

Coloured—Flavour, 41 ; body, 18½ ; closeness, 18 : total 92½.

White cheese bitter, and flavour not characteristic of cheddar.

Coloured cheese more desirable cheddar flavour.

Body of white cheese not so silky as coloured.

Openness of coloured cheese was more marked than in white cheese, but was of a slitty character compared with fractures in the latter. It was more evenly distributed.

Crates 7 to 10 progressively closer than previous crates.

Rinds in all cheeses except 1c and 8w in good condition, particularly white cheese.

No mould penetration in any cheese except 10c.

## Conclusions.

Rough treatment was not sufficient to cause fractures in rinds, and cheese so treated were rather closer than carefully treated cheese.

The absence of mould in 8w and the single cheese purchased indicates that the conditions under which they were held were not conducive to mould-growth. The same defects under favourable conditions for mould-growth would probably have resulted in mould penetration.

This definitely points to the necessity of improved conditions in some curing-rooms, cool stores, ships' holds, and storage warehouses, but does not suggest that rough handling is permissible.

There are a number of points which are of interest—for instance, the more open character of the bottoms than the tops. This seems to indicate that the pressure in the press is not exerted evenly throughout the whole depth of the cheese.

It is not difficult to understand why the ends of the cheese which were resting on the centre boards should be soft, but it is difficult to see why the end of the cheese in the bottom section of the same crate and not in contact with the centre board should be soft also. This has been noticed in the grading-stores in cheese held awaiting shipment.

The openings in the coloured cheese were of an entirely different character from those in the white cheese, being small slits fairly evenly spread over the cut surface. Those in the white cheese were fractures which extended from side to side of the cut surface, and would lead one to expect mould seams to develop readily if the rinds were defective and the atmosphere favourable to its growth.

That would appear to be the determining factor which decides whether mould-growth takes place or not. The shallow but heavy growth of mould in No. 10c indicates that there was no lack of mould spores in the rooms in which the cheese was held, but its absence in

8w, which had a deep cut in the edge, and in the single cheese, which had a fracture right across the cheese at the top end, indicates that it can be controlled.

### Effect of Treatments.

The object of the handling to which the cheese were subjected was to indicate the effect of various treatments:—

Group 1: Careful handling in the factory and during transport.
Group 2: Careful handling in the factory and rough treatment during transport under ordinary stacking conditions.
Group 3: Careful handling at all stages plus careful turning each week in store.
Group 4: Handled roughly in factory plus rough turning each week in store.
Group 5: Handled roughly at all stages.

All crates were stacked on their sides from 10th December, 1936, to 18th February, 1937. After arrival in Wellington they were stacked on end so that conditions in this respect would be the equivalent of grading-store conditions in New Zealand, on shipboard, and in store in Britain.

As the result of the various treatments outlined, one would have expected the latter groups to show more rind defects and more openness than the others, but such was not the case.

It is probable that had this experiment been carried out at an earlier or a later stage when moist conditions prevailed there would have been more mould growth and penetration.

The evidence available supports Mr. Robertson's statement that there are two types of mould penetration; one which gains access through the detachment of either the crown or the bottom of the cheese and the other due to smaller fractures or cracks in the rinds, ends, or rims.

The evenness of the break in the first type gives support to the theory that it is due to huffing, as the fracture, when it takes place at the crown usually follows the concave lines which appear in all cheeses when cut in half. It can be readily believed that the factor which determines whether the top or the bottom of the cheese will become detached is the position which it occupies in the crate. It is possible that a fracture in the rim may act as an outlet for the gas which is responsible for huffing, but rough handling subsequent to huffing is the probable cause of the complete detachment of the end afterwards.

Huffing, while on the shelves, was at one time common, but it is seldom seen to-day, and there is no evidence to show the stage at which it developed in the cheese which were the subject of complaint.

Penetration of mould through smaller defects in the rind can obviously result from a number of causes such as those noted on some of the cheese in the experiment, provided the storage conditions are favourable to its growth. Its absence in these cheese is an indication that it is possible to prevent its growth, and improvement in the conditions in the curing-room suggests itself as the first point requiring attention.

On 10th February, 1937, a circular letter was sent to all cheese instructors asking for information regarding factories :—

(1) Which have built new curing-rooms ; and

(2) Which have improved the ventilation, air circulation, and humidity control in existing curing-rooms ;

Also any action taken in regard to—(*a*) The necessity for close rinds and crowns ; (*b*) clean vat-covers.

Replies indicated that thirteen new factories or curing-rooms provided with good ventilation had been built during the previous year, and that improved ventilation had been provided in thirty-one others, while humidity had also received attention. These numbers have been considerably added to during the present winter.

In his reply, Mr. J. H. Earl, Dairy Instructor, Hamilton, indicated that only five of the twenty-six curing-rooms in the Auckland District were not provided with refrigerators

Other points dealt with were the necessity for washing and drying the shelves after the cheese are removed for packing, fumigation with sulphur and formalin, while comment was made on the use of the curing-room as a general lumber room.

(The provision of a room for the storage of bandages and capes is a noticeable feature of many of the plans of new cheese-factories recently received for approval at this office.)

Points dealt with in connection with rinds and crowns were—Care in filling the hoops and sizing at dressing to ensure adequate pressing, scalding of hoops, quality of cheese-caps, lapping of cap and bandage, oversalting of curd, and draughts playing on cheese on the shelves causing cracked rinds. These are all possible causes of defects in the rind which will give access to mould, and, though commonplace points, their inclusion indicates that they have been noted in some factories.

The course of action to be followed in the future appears to be along the lines followed in the past in regard to supervision in the factories, and as the time seemed opportune to make even greater efforts to impress these points on factory managers and directors with a view to providing improved conditions in curing-rooms, a further circular letter dated 7th July, 1937, was sent to all dairy companies manufacturing cheese in New Zealand suggesting the means to be adopted to achieve this end.

An interesting experiment has been carried out on a South Canterbury farm. On two fallowed fields in February, 1935, drill widths of carbonate of lime were sown—one at 5 cwt. per acre, two at 10 cwt., three at 15 cwt., four at 1 ton, five at 30 cwt., and six at 2 tons. Field A was sown in March, 1935, with 30 lb. perennial rye-grass and 5 lb. red clover, with 1 bushel of oats, which were fed off during winter. Field B was sown in September, 1935, with 20 lb. ordinary rye-grass and 6 lb. of red clover, with oats, which were cut for crop. The results in these two fields show remarkable differences. On field A no results from any treatment can be seen ; on field B the response of the red clover from lime is outstanding, even 5 cwt. giving a good result. The autumn sowing has formed a dominant perennial rye-grass sward. The spring sowing has formed a dominant red-clover sward. The clover has responded to the lime on field B, whereas on field A the clover content is practically non-existent.

—*Fields Division.*

# TROUBLES ASSOCIATED WITH THE FEEDING OF ROOTS.

D. MARSHALL, Veterinarian, Hamilton.

IN many parts of New Zealand the use of roots is standard practice in the winter feeding of cattle, sheep, and sometimes pigs. It is recognized that mangels and turnips consist largely of water. Henry and Morrison give the composition of swedes as water 89·1 per cent., ash 1 per cent., crude protein 1·2 per cent., carbohydrate (including 1·4 fibre) 8·4 per cent., and fat 0·3 per cent. Mangels are almost identical. These foods are therefore low in protein, their chief food value consisting in the carbohydrate.

Before mangels are fed it is essential that they should be lifted and properly pitted for at least a month to six weeks in order that they may mature and certain chemical changes take place. Swedes and turnips may be lifted and pitted, or at least carted off and fed on grass paddocks. This entails considerable labour, and more often sheep or cattle are fenced on a portion at a time of the turnip crop, preferably with a good run off on to grass or rough feed.

There is discussion as to the value of roots in milk-production. In the Waikato soft turnips are valued by some farmers as a supplement during dry summer months, and are believed to keep cows milking. Their succulent nature is valuable at this time. For winter feeding, Boutfleur, of the Harper Adams College, considered roots too bulky as a feed for high-producing dairy cows. He is, of course, a great advocate of a concentrated diet. Other writers, however, consider that roots, up to a point, and properly balanced with other food, will increase milk-production. The average amount fed to dairy cows is up to 56 lb. Bullocks can be run on turnips alone, and will fatten. Dairy cows, however, whether dry and pregnant, or in milk, will not stand this treatment, and additional food is required. Apparently hay is quite a suitable supplement, as it assists amongst other things in providing fibre to allow rumination to be carried out properly.

Where a run-off is provided, this is not of much value unless a fair amount of rough feed is available. Ewes are sometimes run on turnips right up to lambing, but, while no ill results may follow, the practice is a risky one unless a good run-off with a fair amount of roughage and picking is available. Cases of ante-partum paralysis have been seen in ewes on turnips where this precaution was ignored.

In the winter feeding of pigs, roots are useful. Recent information available to the Fields Division at Ruakura indicates that the quality of bacon was improved considerably by including swedes up to 30 per cent. of the ration of pigs, compared with a ration of milk and grain only. The experiment was carried out by Professor Jesperson, of Copenhagen, and it was found that, whereas on the skim-milk grain ration alone only 5 per cent. carcasses reached first grade, pigs gaining 1·6 lb. a day, there was a steady increase in the percentage of first-grade carcasses with an increase in roots until, in the pigs getting 30 per cent. roots, 75 per cent. were graded first, though the daily rate of gain was slightly reduced to 1·1 lb. per day. Mr. Ballinger is carrying out a similar experiment at Ruakura to check results under New Zealand conditions.

It should be remembered that, owing to their low protein content, roots alone are not a sufficient food for young growing pigs or for pregnant sows, and should be balanced with a good protein supplement such as meat-meal or good-quality grain-meal.

### Mortality due to Mangel Feeding.

Mr. B. C. Aston, till recently Chief Chemist to the Department, did considerable investigation of the mortality due to mangel feeding, and as far back as 1911 wrote an article on the subject in this *Journal*, dealing with mortalities in cows at that time. It was his opinion that the poisoning—for such it appears—is due to the formation of nitrites from nitrates in the stomach. The amount of nitrates present is high in certain seasons.

Two years ago mortality occurred in a farm in the Bay of Plenty. The mangels were pulled and left lying in the paddocks, not heaped or pitted, for about a month before using. Though this was the farmer's usual practice, it was evidently not sufficient for proper curing to occur. A load was carted out to in-calf cows about twice a week—about 30 lb. per cow. Mangels were put out one afternoon, and next morning eight cows were dead in the paddock. Nitrates in undue amount were present in the mangels.

Two occasions occurred more recently in which a number of deaths occurred suddenly amongst pigs being fed mangels. The deaths suggested poisoning, but analysis for the common poisons were quite negative, while analysis of mangels revealed nitrates present in more than normal amount. It should, therefore, be realized by farmers that, while mangels are an excellent winter foodstuff, there is risk in their use unless they are properly matured by pitting for some weeks.

One point to be noted in the feeding of any variety of turnip to the dairy cow is that these may give the milk a very strong turnipy odour and taste. This is particularly evident if cows are running all day on turnips and eating shaws and all. It is due to elimination of certain volatile substances by way of milk. It can be largely avoided by feeding the turnips, minus the tops, immediately after milking, and to a less extent by letting the tops wilt before feeding. It is almost unescapable if cows are on turnips all day.

### Redwater.

In the United States of America, South Africa, Queensland, parts of Britain, and Ireland, a type of redwater occurs due to the presence in the blood of a small parasite which attacks and breaks down the red blood cells. It is transmitted by ticks. However, there occurs also in Britain a form of redwater not known to be associated with parasites and called parturient redwater, because of its common occurrence after calving. It is apparently this form which occurs in New Zealand. So far no parasite has been detected in the blood, and also it occurs in parts of the country where ticks are not found. It is believed to be dietetic in origin. It is common in Otago and Southland, often appearing about ten days after calving, and nearly always associated with root feeding. A common history is that cows have been on roots and hay and for some reason the hay ration had been omitted, though the usual supply of roots was eaten. Redwater appears in about twenty-four hours. In the South Auckland district, it has been seen both in pregnant

dry cows and milking-cows under above conditions, or where running on turnips alone, with a poor run-off. It is also sometimes seen about October in the Bay of Plenty in cows on grass.

*Symptoms.*—The urine, if seen, is characteristic, and is any shade from bright red to almost black coffee colour. The mucous membranes lining, eyelids, mouth, nostrils, and vagina are pale and blanched. The heart-beat is loud and the impulse easily felt at side of chest. Cow may continue to feed and milk for a day or two, and, if early symptoms are overlooked, death occurs with apparent suddenness. However, there is usually a period of extreme depression, weakness, and loss of appetite for a day or two before death. Post-mortem will usually show black urine in bladder, and kidneys dark, almost black.

*Treatment.*—Owing to oxygen shortage and heart weakness the animal is in a critical state, and should not be unnecessarily driven or hustled. Drenching also should be carried out with great care to avoid pneumonia, which is a common result. Cow refuses to swallow, and the drench enters lungs instead of stomach.

Salt is an old and usually effective remedy. Give ¾ lb. to 1 lb. properly dissolved in a quart of tepid water, with 1 tablespoon of baking-soda and 1 lb. molasses, carefully as a drench. Rug well, leave quiet, and if animal is still feeding, give plenty of hay sprinkled with molasses. If animal is off feed, stimulants may be given, such as 1 teaspoon of powdered nux vomica and 1 oz. of vegetable turpentine in a bottle of milk, or a bottle of beer. If a case of redwater appears, immediately adjust feeding for balance of cows, reducing turnips and giving adequate hay.

## Turnip Sickness—Turnip Founder.

These names are loosely given to a derangement occurring in dairy cows very often dry and pregnant, under same conditions as produce redwater—unlimited roots with little or no supplement.

*Symptoms.*—There may be marked stiffness suggesting rheumatism, or the gait of a foundered horse. The animal may stagger. In more severe cases, cow may go down and have difficulty in rising. The expression is dull, the pulse weak, appetite gone. There is a desire to drink, and excessive quantities of fluid make the trouble worse. The paunch is frequently distended with fluid and fragments of turnip, and the animal has a full appearance.

*Treatment.*—This should be prompt. Two tablespoons each of common salt, ginger, and baking-soda, with 1 lb. molasses, should be given at once. This may be all that is required. Stop roots for a day or two and feed hay. In more severe cases nux vomica, soda, and molasses should be given in repeated doses (1 teaspoon powdered nux vomica, 1 tablespoon of baking-soda, 1 lb. molasses, twice a day). As with redwater, immediately correct feeding for balance of herd.

## Choke.

This is more likely to occur in stall-fed animals than in the field. A portion of a root slips over the throat and becomes lodged in gullet, very often about the middle of the neck. The animal coughs, slobbers, and stops feeding. The immediate danger is that the gullet is impacted, gas is unable to escape and bloating occurs, threatening suffocation. It is sometimes, therefore, advisable to use trocar and canula, and leave latter in position in the left flank. In some cases the cow will then

herself get rid of the obstruction. If just at back of throat, it may be possible to reach the obstruction by putting a hand into the mouth, remembering the risk of getting one's fingers chewed.

A probang may be cautiously used, if available, or failing that a piece of flexible branch or whiphandle, with a piece of cloth in the shape of a knob securely placed to the end, and the whole well greased. The cow's head should be extended in line with body and securely held by a man on each side before this is attempted. On no account try to push down a rigid stick such as a broomhandle or a piece of steel bar, as the gullet will certainly be punctured.

## CITRUS INDUSTRY.

THE area devoted to both orange and lemon culture in the Dominion is steadily increasing. In comparing the figures set out below with those which appeared in the *New Zealand Journal of Agriculture*, Vol 53, No. 1, page 49 (July, 1936), it will be seen that during the past twelve months, while there has been a decrease of forty registered growers, there has been a gain of 10,246 citrus trees.

From the orchard-registration records the following Table 1, showing the number of registered citrus-growers in the Dominion classified in districts according to size of orchard, as at 1st October, 1936, has been prepared :-

*Table 1.—Showing the Number of Registered Citrus-growers in the Dominion classified in Districts according to Size of Orchard as at 1st October, 1936*

| Group, Number of Trees .. | 1–50 Trees. | | 51–350 Trees. | | 351–1,000 Trees. | | Over 1,000 Trees. | | Total of Trees |
|---|---|---|---|---|---|---|---|---|---|
| District. | Number of Growers | Number of Trees. | Number of Growers | Number of Trees. | Number of Growers | Number of Trees. | Number of Growers | Number of Trees. | |
| Whangarei .. | 200 | 2,384 | 63 | 9,872 | 40 | 20,400 | 3 | 6,553 | 39,209 |
| Auckland .. .. | 739 | 10,762 | 261 | 32,473 | 19 | 9,231 | 1 | 1,350 | 53,816 |
| Hamilton .. .. | 151 | 869 | 6 | 551 | .. | .. | .. | .. | 1,420 |
| Tauranga .. .. | 246 | 2,752 | 99 | 15,693 | 20 | 10,320 | 2 | 3,322 | 32,087 |
| Gisborne .. .. | 183 | 1,816 | 22 | 3,006 | 1 | 420 | .. | .. | 5,242 |
| Hastings .. .. | 201 | 1,845 | 19 | 2,276 | .. | .. | .. | .. | 4,121 |
| Masterton .. .. | 13 | 70 | .. | .. | .. | .. | .. | .. | 70 |
| Palmerston North .. | 218 | 1,204 | 3 | 267 | .. | .. | .. | .. | 1,471 |
| Wellington .. | 24 | 141 | .. | .. | .. | .. | .. | .. | 141 |
| Nelson .. .. | 56 | 381 | 14 | 1,559 | 1 | 450 | .. | .. | 2,390 |
| Mapua .. .. | 36 | 319 | 7 | 520 | .. | .. | .. | .. | 839 |
| Motueka .. .. | 66 | 385 | 6 | 563 | .. | .. | .. | .. | 948 |
| Blenheim .. .. | 93 | 369 | .. | .. | .. | .. | .. | .. | 369 |
| Christchurch .. | 23 | 51 | .. | .. | .. | .. | .. | .. | 51 |
| Dunedin .. .. | 2 | 13 | .. | .. | .. | .. | .. | .. | 13 |
| Trees .. .. | .. | 23,361 | .. | 66,780 | .. | 40,821 | .. | 11,225 | 142,187 |
| Growers .. .. | 2,251 | .. | 500 | .. | 81 | .. | 6 | .. | 2,838 |
| Percentage of total number of growers | 79·32 | .. | 17·62 | .. | 2·85 | .. | 0·21 | .. | .. |

*Table 2.—Lemon and Orange Trees in Registered Orchards as at 31st October in the Years 1934, 1935, and 1936.*

| Kind of Fruit. | 1934. | 1935. | 1936. | Percentage Increase 1936 over 1934. |
|---|---|---|---|---|
| Lemons .. .. | 85,973 | 91,032 | 96,034 | 11·7 |
| Oranges .. .. | 37,399 | 40,909 | 46,153 | 23·4 |
| Totals .. .. | 123,372 | 131,941 | 142,187 | 15·3 |

-*W. K. Dallas, Acting Assistant Director of the Horticulture Division.*

# SURVEY OF CERTAIN CROP DISEASES IN CANTERBURY AND NORTH OTAGO.

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With a grant of the Plant Research Committee, a crop-disease survey was made from December to March, 1936–37. The area covered included all county areas from Amuri in the north to Waitaki in the south, and the distance travelled was 2,500 miles. As this was the first complete survey of such a nature it was decided that primarily it should be in the form of a reconnaissance. Undoubtedly the problems of determining the factors which predispose crops to certain diseases require investigation, but it was considered that first of all a knowledge of the occurrence, distribution, and extent of infection was necessary. Following upon this definition of the areas, if any, where certain diseases were widespread and severe, one would then be able to determine which aspects of the disease problem might require further study. Thus throughout the course of the survey the crops were merely inspected and estimates made of the extent of infection of certain diseases. Little attention was given at this stage to an examination of possible factors which may have been associated with a severe or slight infection.

In view of the time of the year during which the survey was made the only diseases studied were such as occur in maturing crops of wheat, oats, barley, peas, lucerne, red clover, white clover, cocksfoot, and rye-grass.

The following is a summary of the position concerning the cereal crops alone, the complete details of which are published elsewhere :—

## Oats.

### (1) *The Smut Diseases.*

The position with regard to the occurrence of loose smut (*Ustilago avenae*) and covered smut (*Ustilago Kolleri* and *U. laevis*) in oats is shown in the following table. The percentage of smut infection was determined by counting ten five-yard coulter samples at random throughout the field, except where it was obvious that there was no more than a " trace " of infection :—

*Table I.—A Summary of the Degree of Smut Infection in Oats.*

| —— | Algerians. | Gartons. | Other Varieties. |
|---|---|---|---|
| Total number of crops examined .. | 121 | 69 | 30 |
| Unaffected (per cent.) .. .. | 60 | 63 | 47 |
| " Trace " (per cent.) .. .. | 20 | 27 | 5 |
| " Severe " infection (1–20%), (per cent.) | 20 | 10 | 13 |

This table is a summary of a table in which the detailed distribution of the smut diseases is recorded.

During the survey it was found that covered smut of oats (*Ustilago Kolleri*) was much less common than loose smut (*Ustilago avenae*).

These diseases are widely distributed, but no more severe in one district than in another. From Table I it will be observed that, according to variety, from 37 per cent. to 63 per cent. of the oat crops were affected with smut and from 10 per cent. to 20 per cent. were severely infected. From the figures given above, Algerians appear to have been more severely affected than Gartons. This is believed not to be a varietal difference, but to be due to the common practice of sowing unpickled Algerian seed, primarily for green feed. Later such crops may be allowed to go to seed and the infection with smut is then apparent.

The severest infections occurred with lines of unpickled seed. Most of the unaffected crops had been sown with disinfected or pickled seed, but instances have been recorded of smut-free crops grown from unpickled seed. Mr. J. C. Neill in 1926 concluded that oat smut destroyed 600,000 bushels in the South Island, an estimated loss of £135,000.

Apparently the disease has been reduced since 1926 as a result of the greater use of seed disinfectants since then. Thirty-five per cent. of the growers visited during this survey did not pickle their seed-oats, and it is those crops which are acting as centres of infection from which the diseases spread. It appears that there is a possibility of freeing oats from infection with smut if all growers pickle the seed.

In the following table an indication is given of the proportions of various seed pickles used for oats in the area under investigation :—

*Table II.—The Proportions of various Disinfectants used with Oats.*

| Seed Treatment used. | Number of Growers. | Percentage. |
|---|---|---|
| No treatment .. .. | 96 | 35·0 |
| Ceresan .. .. | 50 | 18·2 |
| Agrosan .. .. | 30 | 10·9 |
| Copper carbonate .. | 16 | 5·8 |
| Clark's .. .. | 24 | 8·7 |
| Formalin .. .. | 36 | 13·1 |
| Bluestone .. .. | 22 | 8·0 |

## (2) *Rust in Oats.*

*Leaf-rust* (Puccinia coronota) was widespread, but the disease was not "severe," except in three localities—viz., Kowai, Ashburton-Methven, and Ashburton Main.

*Stem-rust* (Puccinia graminis avenae) seemed to be more "severe" in effect where it occurred, but it was not so widely distributed as leaf-rust early or late in the season. It was "severe" in spring-sown crops of oats throughout all districts. Wherever leaf-rust was found as a heavy infection, stem-rust was also "severe." Thus in the Kowai County, particularly at Amberley and in Ashburton Main and Ashburton-Methven, there were heavy infestations of both rusts early in December. In all other districts stem-rust was not reported until late in January, and then only as a "trace" or "moderate" infection. In view of the heavy leaf-rust infection in the three districts mentioned and the early attacks of stem-rust there, such areas appear to have

been centres of infection this year. Whether or not they or other districts may be recorded as rust-susceptible areas can only be proved by observation in succeeding years.

Further observations on the occurrence of rust will be made in connection with barley and wheat.

### (3) *Other Disease Conditions in Oats.*

*Mildew* was not present this year in any of the 220 oat crops examined during December and March.

*Red Leaf.*—The vivid red colour of the lower leaves of oats draws frequent comment each year. In America Sprague found that the condition was most prevalent in poorly drained soils where there was excessive water and a decreased oxygen-supply. Unduly luxuriant top growth as a result of the lengthy vegetation season is also apt to induce lead-reddening.

This condition appears to be due to some physiological cause. During this survey it was found in all districts and in all varieties but more severely in Algerian oats. Although it was more common in soils which seemed to be poorly drained and was characteristic of autumn-sown crops, some severe attacks have been recorded in crops grown on the very best open-textured soils. It was also frequent on light and sandy soils, in which case excess of water and poor drainage would not be associated factors. The cause and effect of this condition require some investigation.

*Blindness in Oats.*—All crops were affected in some degree with a condition characterized by sterility and whiteness of some of the spikelets. O'Brien and Prentice describe such a condition in Scotland as being due to attack of *Helminthosporium avenae*, which also causes death of seedlings. This condition in oats requires investigation under New Zealand conditions, for in some instances the sterility of the ears was as great as 75 per cent. Usually the affected ears are distributed throughout the field, but in three instances patches of the crop with heavy infestation of blind ears were observed.

## BARLEY.

The barley crops in the area under survey were confined to three districts. The position has been examined under the heading of " district " rather than " disease."

(1) In the North Canterbury district only one crop of Spratt-Archer Barley was examined. It was " severely " affected with leaf-stripe (*Helminthosporium gramineum*). There was only a trace of leaf-rust (*Puccinia anomala*) and mildew (*Erysiphe graminis hordeae*).

(2) In the Ellesmere barley-growing district ten crops of Spratt-Archer, four of Chevalier, and two of Cape Barley were examined. All these crops were free from loose smut (*Ustilago nuda*). The hot-water seed treatment introduced by the Canterbury (New Zealand) Seed Co. has evidently resulted in this disease being controlled completely. The position with barley is much more satisfactory than will be shown to be the case with the wheat crops. In Ellesmere barley crops grown from seed, four years removed from the hot-water treatment, were found to be still free from loose smut. There was no evidence of covered smut (*Ustilago hordeae*) in these crops, the seed of which is treated each year with Ceresan.

Leaf-rust was widespread throughout Ellesmere, all the crops and varieties being infected in " moderate " or " severe " degree. On the other hand, stem-rust (*Puccinia graminis hordeae*) was rare and occurred only in " traces," as revealed by an inspection six weeks after the estimates were made of leaf-rust. During this season there was no correlation between the degree of severity or the occurrence of leaf-rust and stem-rust in barley as has been suggested in the case of the two rusts of oats.

The ten Spratt-Archer crops were affected with leaf-stripe, five of them revealing " severe " infection. The four Chevalier crops were much less affected and showed only a " trace " of stripe. Cape Barley also revealed only a " trace." The stripe disease is apparently reduced by the seed hot-water treatment. There was no sign of the disease in the crops directly removed from the treatment, while crops grown from seed once or twice removed were the ones which showed a " trace " of stripe.

Mildew was present in " traces " in all varieties.

(3) In the Waimate barley-growing district smut was more common. This was especially so in the six crops of Cape Barley, all of which showed a " trace " of covered and loose smut. In the Chevalier variety the two smuts were recorded as " traces " in two of the four crops inspected. Few lines of barley-seed in this district have been hot-water treated during the past three years. Leaf-rust in this district was not so severe in the barley crops as in Ellesmere. There was no more than a " trace " of infection in about 20 per cent. of all the crops of barley. There were " moderate " infections with leaf-stripe, while mildew was not recorded in any of the crops.

## WHEAT.

### (1) *Loose Smut (Ustilago tritici).*

" Traces " of loose smut were found in all districts. Estimates of infection were determined in the same manner as in the case of smut in oats. An infection over 0·4 per cent. is considered " severe " though the actual loss in yield resulting from such an infection might not be noticeable. On this basis the extent of " severe " infection in the varieties was determined as follows :—

| | | | |
|---|---|---|---|
| Tuscan .. .. | 9·4 per cent. | Garnet .. | 20·0 per cent. |
| Dreadnought .. | 5·4 per cent. | Cross 7 .. | 22·0 per cent. |
| Velvet .. .. | 11·5 per cent. | | |

This information is derived from a detailed table of the distribution and degree of loose-smut infection which is too lengthy to be published in this summary.

Estimates have been made also of the percentages of crops inspected which showed at least some degree of loose-smut infection. Over all the districts there was no infection whatever in the Hunters variety, but with the other varieties the following are the percentages of crops which were infected in some degree with loose smut :—

| | | | |
|---|---|---|---|
| Cross 7 .. .. | 95·0 per cent. | Velvet .. | 46·0 per cent. |
| Dreadnought .. | 85·0 per cent. | Marquis .. | 30·0 per cent. |
| Garnet .. .. | 70·0 per cent. | Jumbuck .. | 20·0 per cent. |
| Tuscan .. .. | 58·0 per cent. | | |

From these figures a greater proportion of the Cross 7 crops were infected than any other variety, while the proportion of Jumbuck crops

infected was lower than any other variety apart from Hunters. A considerable number of farmers are still under the impression that loose smut may be controlled by external seed-disinfection. They look upon the presence or absence of loose smut in the growing crop as an indication of the efficiency of the various seed steeps and dusts which have been used.

It seems that much more wheat should be hot-water treated to control loose smut. The practice of growing "home" seed, which is slightly infected, for years on end favours the spread or persistence of this disease. The length of time the treatment remains effective as a control seems to vary. In the case of Tuscan some lines four years removed from hot-water have been found to be quite free from the disease, while others become infected in the first year after treatment. Cross 7 is evidently more susceptible to loose smut than Tuscan, and the effectiveness of the hot-water treatment is not very lasting in the former variety. The extent of loose-smut infection has varied with the district. In Amuri and Waipara the infection figures were lower than in any other of the counties—*e.g.*, the percentages of the Tuscan crops in these two districts which were affected with loose smut were 25 per cent. and 14 per cent. respectively. These figures are compared with 87 per cent. infection in this variety in Geraldine, 78 per cent. in the Wakanui district of Ashburton, and 78 per cent. in the Levels County. In America loose smut of wheat or barley rarely occurs severely in the Pacific Coast States or in areas of that Continent where the relative humidity of the air is low at the time of flowering of these cereal crops. The low infection of loose smut in Amuri and Waipara, which are considered to be dry areas during November, supports the American experience that damp and humid weather at *flowering-time* is the only climatic factor favouring the spread of loose smut.

### (2) *Covered or Stinking Smut of Wheat (Ustilago levis).*

It is possible that covered smut of wheat is to-day a disease of little importance throughout the wheatgrowing districts. The practice of seed-pickling wheat seems to have eliminated this disease. This opinion has been formed as a result of discussions with grain-merchants who handle large quantities of grain each year.

*Dalgety and Co., Christchurch,* during the past five years have had a number of infected lines, but the degree of infection was always very low. About five years ago the most severely infected sample was received containing 10 per cent. of diseased grain. The disease has varied with season and the type of land. In some seasons it is centred in the foothill districts—*e.g.*, Hororata, Oxford, Springfield. At other times Southbridge, Darfield, Dunsandel, and Chertsey have been areas from which numbers of infected lines have been received. Tuscan is the variety which has been most affected. It is concluded that over the past twenty years there has been a marked decrease in the amount of smutted wheat and barley due to (1) the fact that farmers change their seed more often and use certified seed; (2) the increased use of smut-controllers such as Ceresan and Agrosan.

*Canterbury Roller Flour Mills, Ashburton,* receive samples of wheat each year showing traces of stinking smut. Pearl is the variety in which the trouble is most pronounced. Ashburton is not affected to any extent, smut occurring in isolated cases through carelessness in pickling or absence of dressing of any kind.

*Wright, Stephenson, and Co., Oamaru,* in the past five years have seen very few lines of wheat affected and have not been able to trace it in barley during that time. It has occurred principally in Dreadnought and Hunters. Since the treatment of wheat with Agrosan and Ceresan, smut has become insignificant. It is believed that where grain is stacked before threshing the ball smut is readily blown out in the threshing and not broken up, causing infection of the whole sample.

*Proteena Milling Co., Ashburton.*—Smut-infected lines received from Hinds, Laghmor, and Flemington. It is considered that the damage is slight, and infection has steadily diminished during the past ten years.

*Fraser and Co., Dunedin.*—The disease is not so prevalent as twenty years ago, when it was particularly severe in the Taieri district. Tuscan has been the most widely affected variety.

*Canterbury Farmers' Co-operative Association, Ltd., Geraldine.*—During seasons 1932–34 several affected lines were received, all Tuscan or Hunters. The worst cases were from Orari where farmers grew seed of their own saving which had been affected previously. It is considered that the consistent use of Ceresan is a definite deterrent.

*Turnbull and Co.*—During the past five years there has been a gradual decrease in the quantity of wheat affected. During 1935–36 no diseased lines were obtained.

From the above it is apparent that the position with regard to the externally borne smut-disease of wheat is much more satisfactory than has been indicated in the case of oats But even though ball smut is eliminated from wheat it is wise to continue using the new organic mercury dust on account of the improved yields that are secured as a result of their use. Very few farmers use untreated wheat-seed. The following table shows the present position concerning the practice of pickling seed wheat. The figures given were derived from a questionnaire of 236 farmers in the area surveyed.

*Table V.—The Use of Seed Disinfectants with Wheat.*

| | | | |
|---|---|---|---|
| Ceresan | 30·0 per cent. | Clark's | 15·2 per cent. |
| Agrosan | 18·5 per cent | Formalin | 16·4 per cent. |
| Copper carbonate | 9·0 per cent | Bluestone | 10·7 per cent. |
| Total dry dusts, 54·5 per cent | | Total wet pickled, 45·5 per cent | |

Ceresan and Agrosan are becoming very popular. Wet pickles are certainly being replaced and less of these are being used.

### (3) *Mildew of Wheat (Erysiphe graminis tritici).*

Mildew has been found in all districts, but during this year seems to have been a disease which caused little damage to crops. The disease is not at all characteristic of the wetter districts as is generally believed. In the Waitaki County, where very dry conditions were experienced all through the past growing season, mildew in wheat was common. The severest attacks occur in dense crops on heavy land, but the disease has been recorded frequently on drier soils where the crops are thin and open. An estimate of the varietal differences was obtained in which the mean percentage of crops infected over the area investigated was calculated as follows:—

| | | | |
|---|---|---|---|
| Tuscan | 57·8 per cent. | Jumbuck | 29·0 per cent. |
| Hunters | 60·8 per cent. | Dreadnought | 30·6 per cent. |
| Cross 7 | 39·3 per cent. | Velvet and Pearl | 57·0 per cent. |

In certain areas Cross 7 has exhibited a degree of resistance to mildew compared with other varieties. In three fields in particular—one in Waitaki, one in Malvern, and one in Ellesmere—Cross 7 and Tuscan had been drilled in two halves of the same field. In each of these cases the Cross 7 was quite unaffected, while the Tuscan in the other half of these fields revealed " moderate " infection. The difference between Dreadnought and Tuscan in the Waimate district was also notable. In this district mildew was rarely found even in traces in the Dreadnought variety. In all districts Hunters exhibited the greatest susceptibility to mildew, although Jumbuck often showed mildew infection of the green ears, which was rarely noticed with the other varieties.

### (4) *Take-all of Wheat.*

In general, the term " take-all " has been used to describe a number of disease conditions. Strawbreak, whiteheads, and spring-yellows (a phase of foot-rot in which the plants are stunted as a result of fungus attack of the roots) have all been attributed to take-all. The true take-all disease caused by *Ophiobolus graminis* is characterized mainly by the presence of circular patches of stunted plants. The tillers of affected plants are covered with a black discoloration at the base. As Table VI shows, this phase of the disease was not recorded very frequently during the course of this survey.

*Table VI.—The Occurrence of Take-all in Wheat.*

| Tuscan. | | Hunters. | |
|---|---|---|---|
| Severe. | Trace. | Severe. | Trace. |
| 1 crop (Springs).<br>1 crop (Kaiapoi).<br>1 crop (Amuri). | 2 crops (Springs).<br>1 crop (Kaiapoi).<br>1 crop (Rangiora West).<br>2 crops (Levels). | 1 crop (Springs).<br>1 crop (Kaiapoi).<br>1 crop (Rangiora East).<br>1 crop (Rangiora West). | 1 crop (Rangiora East).<br>1 crop Waipara. |
| Garnet : 1 crop (trace), (Ashburton–Wakanui). | | | |
| Velvet : 1 crop (trace), (Waipara). | | | |

In some districts during the past season, particularly in Rangiora East, Kaiapoi, and Waitaki, the presence of large numbers of bleached, sterile ears before ripening has caused concern among growers. Many of these attacks of whiteheads and strawbreak are considered to have been due to late attack by *Ophiobolus graminis*, which usually causes the stunted condition in autumn-sown wheat. It has been concluded that a number of whitehead conditions have occurred due to the following causes :—

(1) *Drought.*—In Waitaki most of the bleached, sterile ears were most likely due to this cause.

(2) Mechanical fracture of the tillers by insects, particularly weevil and hessian fly. The latter pest has been more prevalent than usual during the past season, one crop in Ellesmere showing at least 50 per cent. loss of tillers due to fracture caused by hessian fly.

(3) Whiteheads associated with a late spread of infection and attack by the take-all organism (*Ophiobolus graminis*).

(4) Whiteheads due to the rotting of the base of the tillers through attack by foot-rotting fungi (*Fusarium* spp.).

### (5) *Diseased Ear Conditions in Wheat.*

*Brown Chaff.*—Cross 7 crops were affected generally with a condition characterized by brownish-black glumes and a black discoloration of the stem just below the ear. This was recorded rarely on other varieties. Work in America has shown that brown or black chaff may be due to bacteria (*Bacterium atrofaciens*), to fungi (*Alternaria* spp.), or the cause may be physiological in nature. In the crops examined during the survey the condition appeared to have no adverse effect upon the growth of the plants.

*Wheat Scab.*—At harvest-time there may be found a number of plants the heads of which are compressed, with tight and discoloured chaff. The spikelets are usually sterile or any grain formed is bleached and shrunken. During this survey such attacks of scab were never found in any degree. Traces were recorded in crops throughout all districts.

*Blackheads.*—Affected ears become grey-black in colour at maturity and are covered with spots of a sooty-black mould. The condition spreads rapidly while the crop is standing in stook, especially during a wet harvest. This disease has been shown by F. T. Bennett to be due to the organism *Cladosporium herbarum*, a fungus which develops mainly on mature crops during damp seasons and which is not directly parasitic, but spreads on plants which have been weakened by other causes.

During the harvest of 1937 this blackheads condition was reported frequently throughout North Canterbury. A severe storm early in December, 1936, caused many crops to lodge, and such damaged crops later revealed heavy infestation with *Cladosporium herbarum*, especially during the following January and February, when further wet conditions prevailed.

### (6) *Rust in Wheat.*

The most widespread leaf-rust (*Puccinia elymi*) infections were recorded in Kowai, Malvern, and in the three Ashburton districts—Methven, Main, and Wakanui. Amuri and Waipara were almost free of leaf-rust infection. In no case during this season was leaf-rust so severe as to cause significant damage to crops. Differences in varietal infection have been calculated from the tables of the occurrence and degree of infection which have been prepared. From these tables the average infections of the varieties over all the districts were as follows :—

| | | | |
|---|---|---|---|
| Tuscan | .. 61 per cent. | Velvet | .. 65 per cent. |
| Jumbuck | .. 66 per cent. | Cross 7 | .. 64 per cent. |
| Hunters | .. 60 per cent. | Garnet | .. 63 per cent. |

From the information which has been obtained there seems to be little difference in the varieties grown at the present time in respect to the extent of leaf-rust infection.

At the time of making the leaf-rust survey (December, 1936) little stem-rust (*Puccinia graminis tritici*) was noticed. At the end of January, 1937, all North Canterbury districts were inspected again. It was found that where leaf-rust had been recorded as "severe" during the first inspection—*e.g.*, Kowai, Malvern, and the three Ashburton areas—stem-rust was also present in the crops. Only in these districts were there any crops severely infected with stem-rust.

# SEASONAL NOTES.

## THE FARM.

### The Coming Month.

GIVEN favourable weather, farmers as a rule are very busy during September. Indeed farmers who are not faced with more work than they can cope with conveniently in September either are particularly fortunate in having their work well forward, or, as is more likely, are not giving due attention to all the tasks that should be carried out. Successful farmers, while always alert to make the best possible use of all available time in September, do not allow their zeal in this respect to lead them into the error of carrying out cultivation work when the land is too wet—more harm than good readily results from working those soils which are at all heavy in texture when they are so wet that glazed furrows are produced in ploughing and that the soil clings to implements. There are in New Zealand extensive areas of open sandy soils which may be cultivated without harm to their texture when they are markedly wet, but, on the other hand, much of the land that is used for arable cropping suffers substantially if cultivated when in such an undesirably wet condition that it does not tend to crumble under the action of suitable implements. One immediate result of working overwet heavy soils is the appearance of clods when drying takes place, and it is usually both difficult and costly to reduce clods to a good tilth for cropping.

### Provision of Special Feed.

The level of live-stock production that is to be attained both in the coming season and in the following one will be determined to a considerable extent by the manner in which farmers make provision of special forage for use during periods of scant pasture-growth. An important matter that deserves attention because of the frequency with which there is neglect in regard to it lies in the fact that pastures commonly fail as a direct source of feed for dairy cows much earlier in the summer than seems commonly thought to be the case; while many farmers devote all their attention to remedying February feeding weaknesses, actually pastures often begin to prove insufficient as early in the season as Christmas. Hence there arises a midsummer period of inadequate feeding to which little attention is given, but which is reflected in an unduly rapid decline in butterfat-production.

Feed of a highly digestible non-woody character is required at this period. Young green lucerne following a first cut of the crop removed in good time, the leafy grass aftermath on a paddock from which silage was obtained at a suitably early date, and soft turnips of a quickly maturing type sown early are three sources of forage which may be successfully utilized in this connection. In planning the provision of special summer feed it is well to bear in mind that the season may be better than the average one, and that when it is so it is in the interest of economy of feed to be able to convert any surplus into hay or silage, and this it is impossible to do if the summer surplus consists entirely of such crops as rape and soft turnips.

A second matter calling for more attention than it receives is that the most marked feature of the normal provision of summer feed is its deficiency, not in quantity, but in quality: the stock often are given access to plenty of feed of a sort which is not the one that they particularly require. The three types of feed just mentioned—leafy lucerne, leafy grassland aftermath, and soft turnips—provide summer rations of suitable quality for dairy stock.

### Feeding of Sidelines.

In planning the special cropping for the season provision should be made to meet the requirements not only of the main class of stock on the farm, but also of subsidiary classes such as pigs and poultry, on dairy-farms, and these together with cows on those farms on which grain or sheep are the main consideration. Many farms on which dairy cows, pigs, and poultry are sidelines obtain very poor financial results from these sidelines because of the poor feeding of the sideline live-stock. The present season of the year is the one in which to initiate steps to rectify this common weakness

For use in the winter period mangels, carrots, chou moellier, swedes, and turnips are all suitable. Except in the more severe and southern districts mangels give outstanding results when accorded good fertility and good cultivation They are markedly reliable, being practically free from attacks of any serious disease or pest ; they can withstand dry periods comparatively well, and under suitable culture their total yield of nutriment per acre is very high Because of these facts they are specially advisable on costly fertile land, and they should be grown more extensively than it has been customary to grow them As they require considerable attention, they should be located preferably in a position convenient to the homestead, where they are more likely to receive the weeding and cultivation that is essential to success than if they are grown in an out-of-the-way situation.

As a rule swedes and turnips may suitably be grown instead of mangels when the farming is of a more extensive type, so that the standard of crop culture necessarily tends to be lower. Carrots are suited to free soils on which, as Taranaki results in particular show, exceptionally good yields can be obtained without an unduly heavy outlay of labour. With full justification chou moellier continues to be popular, and probably to grow in popularity for use on ground which is naturally fertile or which has been made so Chou moellier is especially suitable on land which is likely to be so wet at the time of feeding-off as to make the use of swedes wasteful Chou moellier is also very suitable when club-root is known or expected to occur in the land to be cropped Chou moellier though not immune to club-root is so resistant to it that good yields of chou moellier are obtained when swedes and turnips fail because of club-root infection.

Lucerne should be grown to a much greater extent than it now is. While profitable results from lucerne are being obtained over a wide range of conditions of soil and climate, the most highly productive crops are, as a rule, on distinctly fertile soils. A permanent vigorous crop of lucerne is of such great value that a fertile area should indeed be allotted to it. Poorly drained conditions are to be avoided for lucerne. Much information about lucerne culture is contained in Bulletin 155, obtainable free by applying to the Department of Agriculture. The success which attends the establishment of lucerne depends to a large extent upon the initial work The initial steps in lucerne-growing should be based on the latest knowledge available, which enables many of the failures that characterized past efforts with lucerne to be avoided.

### General Work with Crops.

Preparatory cultivation for both mangels and lucerne should be commenced soon, if it has not been started already. If at this stage it is proposed to plough old pasture for either of these crops, one deep ploughing will almost certainly give best results provided the furrows are well turned over so as to bury completely the surface layer which usually

contains a big population of weeds or their seeds; these, if brought to the surface again by a second ploughing, would be likely to give trouble in the following crops.

Land for the potato crop which was skim-ploughed in the autumn should be ploughed deeply about September in preparation for the later cultivation needed to give a suitable seed-bed. In preparing the seed-bed it should be kept in mind that the potato thrives in a loose rather than in a compacted soil.

When cereal-sowing has been done the implements may suitably be kept at work on land in preparation for rape, chou moellier, and root crops. By cultivating such land in good time one most readily secures the type of seed-bed which is required—that is, fine from the bottom upwards.

It is often advisable to close up lucerne areas in September in order to obtain an early cut. An early cut is of twofold value: it removes plants which invade the lucerne to its detriment in the spring, and which do not appear prominently in subsequent growth during the season, and it gives much probability of an additional cut each year.

### Fields for Ensilage and Hay.

Pastures intended for haymaking and ensilage should be grazed off evenly and closed up as soon as they can be spared from grazing. Early closing of such fields is advisable, because it tends to lead to early mowing, which in its turn gives greater probability of a good aftermath that is generally very useful when the dry summer weather makes its effect felt. A top-dressing with superphosphate at closing-time of fields intended for ensilage or haymaking is often advisable especially in the case of fields not recently top-dressed. All material such as wire, timber, &c., likely to cause delays or breakages in mowing should be removed carefully from the fields prior to closing them.

### Utilization of Feed.

Cows, during the early part of their milking-season, require feed relatively rich in protein; protein is required for the production of milk which contains proteins. Hay or silage made from pasture-growth that was at the flowering-stage or a more mature stage when mown is likely to be of low protein content unless clover was especially abundant in the herbage. The darker the colour of the silage the lower is likely to be its content of digestible protein, and it is the content of digestible protein which really matters—dark silage results usually from high temperatures during the ensiling process, and as the result of such high temperatures digestible protein tends to be turned into an indigestible condition. Short leafy pasture-growth is relatively rich in protein—in fact, in some circumstances it may be excessively rich—but often in September the available supplies of it are insufficient to meet the needs of the herd. If it becomes necessary because of this to make hay or silage the main constituent of the diet of the herd, then it should be borne in mind that well-made clover and lucerne hays are relatively rich in protein. Failing such hays, silage or hay made from the leafiest pasture (if rich in clover so much the better) should be kept for use at this period. If the grass-supply is poor and hay and silage in unduly scant supply, it may quite well prove profitable to feed milking-animals some concentrates which are rich in protein, such as linseed cake, oats, or bran. If "bloating" occurs in cows grazing on short leafy pastures, the feeding of hay or silage is likely to be of value in lessening the trouble.

### Seasonable Work with Pastures.

Whether top-dressing of established pastures in September is likely to be profitable depends to some extent on particular circumstances. If there is promise of an ample supply of growth for all requirements up to Christmas, including ensilage and haymaking, then the case for September top-dressing is not at all strong. But if additional growth for hay or silage production is required, then top-dressing in September of established pastures may be well worth while.

It is usually profitable to apply phosphates to a pasture at the time of sowing or shortly afterwards. Such top-dressing tends to provide the seedlings with greater vigour, which assists them in passing successfully and more quickly through the critical young stage.

Grass-harrowing in September is likely to be very advisable on those paddocks on dairy-farms on which stock have been held for winter feeding. It is especially desirable to harrow at this stage fields from which it is intended to harvest hay or silage during the coming summer —the harrowing should be done just before the time of closing-up.

*—R. P. Connell, Fields Division, Palmerston North.*

## THE ORCHARD.

### Spraying Operations.

By the time these notes appear, growers will be considering their spray programmes for the coming season, consequently it is necessary to see that all appliances used in spraying operations are in good working-order. Too many growers are apt to neglect these precautions, and, when spraying should actually start, find that their spray-pumps, pipes, taps, rods, or nozzles need attention. In consequence much valuable time is lost. Unfortunately for the grower, fungous diseases will not postpone development until all these defects are remedied. Many instances could be cited where growers have been heavy losers by not applying the initial spray at the proper time.

### Overhaul of Plant.

Therefore it is strongly recommended that all those growers who have not, up to the present, overhauled their plant do so as soon as possible, in order to get a good start at the right time. The time of application of any spray is an important factor in the control of pests and diseases. Do not leave the ordering of the necessary materials until the last moment. It is better to have them stored in a shed ready for use than to be disappointed because the firm supplying the order is temporarily out of stock. Although spraying is an operation that the average orchardist does not look upon with any great favour, yet, if a good start is made with the first spray, future spraying not only appears easier, but growers are likely to secure more successful results.

There are quite a number of points to remember in successful spraying, and of all of them probably the most important are—(1) Proper plant; (2) proper materials; (3) proper time; (4) correct methods. All growers realize that no spraying can be successfully carried out without proper plant. Whether the plant be "stationary" or "portable," it must be of sufficient power to cope with all emergencies that are likely to occur during the spraying-season.

#### Proper Materials.

The question of proper materials needs some explanation, and owing to the fact that the use of any but the proper specifics may result in heavy loss to the orchardist. It appears that too many specifics are being placed on the market, many of them not tested claiming to be a " cure all " for the numerous pests and diseases to be found in the orchard. Growers are strongly advised to consider fully the matter before venturing with a more or less unknown and untested spray, but to stick to those materials which have been thoroughly tested under all conditions, and known to give the best possible results. Let the new specifics be experimented with at the places appointed for such work—viz., the research stations, before being used by the orchardist. In these days of increased costs, &c., a grower cannot afford to use any spray material that is not likely to be fully effective.

#### Time of Application.

The third point, the time of application, is an important one, and should be given every consideration by the grower. It must be remembered that all sprays for fungous diseases are applied in anticipation of attack, and that control depends largely in keeping a protective cover on the developing foliage and fruit until all danger of infection has passed. Although exact dates cannot be given for the different spray applications, all spray programmes are arranged in accordance with growth periods such as bud-movement, green-tip, petal-fall, &c. Therefore it is necessary that growers watch the development of their trees and spray accordingly. It must be stated that although all scheduled sprays throughout the season are necessary for the protection of clean fruit, the early sprays are the most important, and that time lost at this period cannot be recovered. Special reference is made to the " base " or " foundation " sprays, without which no grower can expect to get satisfactory results.

It is hardly necessary to dwell much on the fourth point—proper methods—except to state that thoroughness in application of sprays is a necessity. Some orchardists are inclined to rush through the spraying, just to get it finished, and later in the season they wonder why so much disease is prevalent in the orchard. An examination of the trees in such orchards after spraying would show that only a portion of each of the trees had been covered, leaving the balance unprotected from diseases. Good nozzles, adequate pressure, constant agitation of the spray, correct measurement of materials and mixing of the sprays, and complete coverage, are most essential.

#### Spray Schedules.

Slightly different spray programmes are necessary for each different fruit district in the Dominion, depending on the climatic conditions prevailing, consequently it is advisable for growers, when in doubt, to get into touch with the Orchard Instructor for the district, when all necessary information will be supplied.

As it will only be necessary to apply the initial or " foundation " sprays before further notes appear in the *Journal*, only these will be discussed here, deferring the issue of a general programme for the season until next month.

In arranging any spray programme due consideration must be given to the different varieties grown, and their susceptibility to injury or disease. Again both insect pests and fungous diseases must be considered. The three principal and well-tested sprays are winter-oil, lime-sulphur, and Bordeaux mixture. If San Jose scale is present a thorough application of winter-oil at strength 1–20 will be necessary; this spray will also control mealy-bug, cottony-cushion scale and other scale insects. Lime-sulphur at strength 1–10 will also have a controlling effect on San Jose scale, as well as destroying many red-mite eggs. Bordeaux at a strength of 5–4–50 is undoubtedly the

best foundation spray in the majority of varieties for the control of black-spot, and will do much to ensure a clean crop throughout the season. Some growers, when considering the control of both insect and fungous diseases, combine the winter-oil with Bordeaux mixture. This is a saving of labour, &c., but it is preferable to use them separately. For the control of black-spot on pears a foundation spray of Bordeaux mixture at strength 5–4–50 should be applied, taking care to cover every part of the tree. Peach leaf-curl, brown-rot, &c., on stone-fruits can also be kept well in check by an application of Bordeaux mixture 5–4–50 when the terminal leaf buds begin to swell.

### Cultivation.

In many instances the cultivation of the orchard is not given the attention necessary to enable the fruit-tree to function properly throughout the season. Some growers maintain that, providing a liberal supply of manure is given every season, cultivation does not matter. This is an erroneous idea, the proof of which can easily be seen in almost every district. The turning-under of the cover-crop should be proceeded with immediately, to enable rotting of the vegetable-matter to take place before the trees start into growth. Where no green crops were sown, the ploughing should have been completed before these notes appear, and the work of breaking down the furrows carried out as soon as weather conditions permit. Attention should be given to cultivation around the base of the trees. Neglect in this respect not only makes the orchard look unsightly, but creates a harbour for all kinds of pests and disease.

### Manuring.

The depletion of the food from the soil by the yearly production of fruit is appreciated by growers, and much more attention is being paid to manuring than formerly. The value of green crops for the supplying of humus and nitrogen cannot be overestimated, but still a regular manurial programme is as essential as a regular spraying programme if success in orcharding is to be attained. Only a general outline with regard to manuring can be given, each district having its soil differences, in fact, each orchard presents a different problem. Generally speaking, a combination of the three essential elements—nitrogen, potash, and phosphates—give the best results, although in some instances modification is necessary. Growers should study their trees from year to year, watch results as far as growth, cropping, &c., is concerned, and apply manures to improve the fertility of the soil If growth is lacking an application of nitrogen should be given, whereas if the fruit is lacking in colour, spurs weak, and crops small, potash should be applied. An application of carbonate of lime at the rate of 1 ton per acre every three or four years will do much to correct acidity in the soil, enable the bacteria to function, release plant-food, and improve the physical condition of the soil.

—*George Stratford, Orchard Instructor, Motueka.*

### Citrus Culture.

Sweet oranges have been grown and sold in New Zealand for many years past, but the quantity produced by any one grower has, in most cases, been small. This condition has resulted in haphazard methods of harvesting and marketing, little study or attention having been given to ascertaining the most suitable dates for harvesting the different varieties. During the last two or three years in particular, this aspect of orange-culture has received greater attention and many observations have been made.

There are various scientific methods of determining when a sweet orange has reached that stage of maturity that it is suitable for dessert use, but it is not intended here to explain these technical methods. The sweetness

of the juice and the lack of acidity, as judged by the palate, is the simplest method of determining maturity. When making such tests it is a good practice to have in hand a good-quality imported orange for the purpose of making comparisons. When fully ripened, the principal varieties grown in New Zealand should be equally as sweet as the best imported fruit.

It is estimated that fully 75 per cent. of the sweet oranges grown and marketed in New Zealand are harvested before the most desirable stage of maturity has been reached. This common error of judgment has had the unfortunate result of creating the impression amongst many consumers that the New-Zealand-grown fruit invariably lacks sweetness, which is contrary to fact. Until this impression is removed, New Zealand oranges will not command the degree of popularity that they deserve.

No fixed dates can be set for the commencement of harvesting the different varieties, as both the season and the locality are liable to make considerable differences in this particular. However, under average conditions, there are few, if any, varieties that are fit for harvesting before the middle of July, and fruit that is reasonably fit for marketing at this date would certainly improve in flavour if left on the trees for a further few weeks. Late varieties such as Valencia, St. Michael, and Lue Gim Gong should never be harvested before October.

There is a danger with certain varieties, particularly certain strains of the Navel orange, for the fruit to lose its juice if allowed to remain on the tree for any appreciable period after reaching full maturity. There is evidence which indicates that trees grown on the citronelle stock are most likely to become affected in this way. The citronelle stock is also liable to cause the same trouble in Valencia oranges when allowed to remain on the trees until late November, although by no means does this occur in every instance. Young trees that are making vigorous growth are most susceptible to this trouble. Where the danger exists care must be taken to harvest the crop before the loss of juice commences.

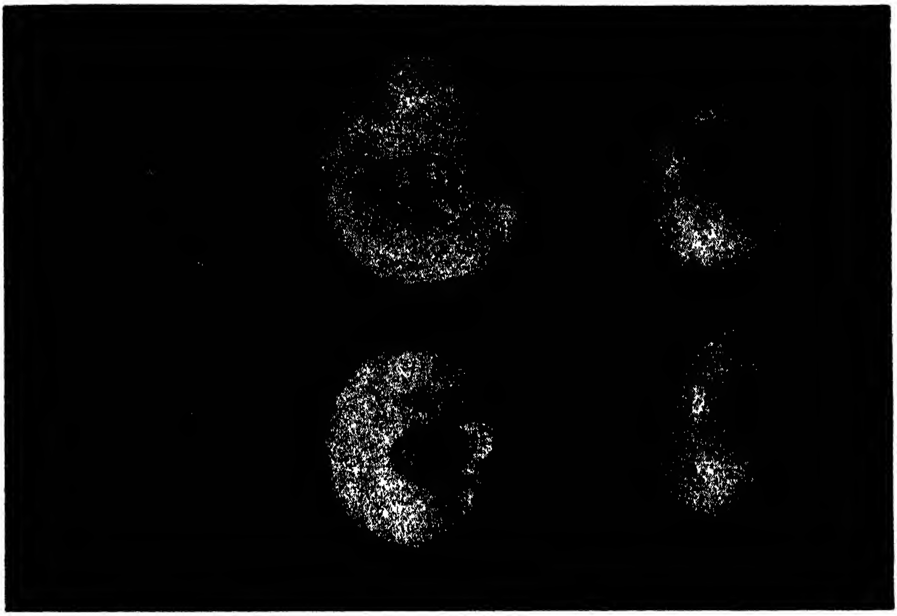
### New Plantings.

Where the planting of young citrus trees is contemplated, a thorough preparation of the soil is of great importance, and the work entailed is a profitable investment. The importance of providing adequate shelter before the trees are planted out cannot be overstressed. In most circumstances where shelter has not already been provided, the best results will be secured by planting the trees in nursery rows, where they should reman for one or two seasons while the shelter is growing. In most localities where citrus trees do well the present is a suitable time for planting. Where frosts are still to be expected, the trees should be protected; light brushwood arranged around the trees in pyramid form is a suitable method of guarding against frost damage, and at the same time affords protection from cold wind, without completely shutting out the beneficial rays of the sun. A heavy mortality rate in newly planted trees is not uncommon, especially when a dry period follows the planting. Probably the most common cause of this mortality is allowing the roots to become dry or partially dry before planting. Where this occurs no amount of irrigation after planting will completely counteract the detrimental effect.

### Washington Navel Orange.

In view of the increased interest now being taken in the planting of sweet-orange trees, a word of warning appears to be desirable regarding this variety. In many orange-producing countries the Washington Navel is the most popular variety grown commercially, yet in New Zealand by far the greater number of trees of this variety are producing fruit of a very poor quality. The greatest factor in bringing

about this unfortunate result is believed to be lack of adequate bud selection, while the use of an unsuitable stock has also probably accentuated the position in many cases. The fact that a few Washington Navel trees in New Zealand are producing heavy crops annually of the best-quality fruit indicates that the fault does not lie in the variety. The poor strain of Washington Navel, as shown in the accompanying illustration, usually



WASHINGTON NAVEL TYPES.

Four on left inferior strains, two on right desirable.

has a thick rind, the partitions are irregular, and it is deficient in juice. Also, when allowed to remain on the trees for any appreciable period after reaching full maturity, the juice content rapidly diminishes. Fruit of the best strain, when the tree is grown on a suitable root-stock, will usually retain its full juice content on the tree until late in October, and sometimes even much later in the season.

—*P. Everett, Orchard Instructor, Gisborne.*

## POULTRY-KEEPING.

### The Eggs.

It is well known to every one that the small yet important and very palatable article of diet, the egg, is very commonly used, but it is doubtful whether many realize the full value of this item of food. Owing no doubt to its high food value and the ease with which it can be prepared, the egg is one of the most commonly used articles of food of animal origin. No other animal food can be used in so many varied ways, and got ready for use in so short a time.

The egg contains those food principles that best nourish the body, and we are told by those qualified to speak on such matters that the chemical composition of the egg and of the human body are nearly the same, and that ten eggs are equal in food value to 1 lb. of beef, but that one dozen

eggs would better serve a family of five or six. The egg is used in many different forms not only for adults, but for the child, the youth, the strong, and the invalid.

In addition to its food value, the egg is at times of value for other purposes. For instance, the white of the egg is a known remedy for burns. Egg-shells, on account of the purity of carbonate of lime contained therein, are sometimes used for the making of medicine. In his interesting survey of the poultry industry, Mr. E. J. Fawcett, Technical Liaison Officer of the Department of Agriculture, estimates that the approximate consumption of eggs in New Zealand is just on 300 per person per year, which means that the people of this Dominion, with its population of 1,578,757, consume approximately 39,469,758 dozen eggs each year. It has been estimated that England produces more than half the eggs consumed by its population, yet the latest statistics show that it costs that country some £16,000,000 sterling per annum for imported eggs.

### Care needed.

The lack of appreciation of the perishable nature of the egg is causing a heavy annual loss in this country. The poultry business is one that depends to a great extent on the constant attention to detail in order to ensure success, and it is doubtful whether any branch of primary industry calls for more particular attention than the care and preparation of the egg for market. In fact, there is a great correlation between the successful poultry-keeper and the way he sends his eggs to market.

### Desirable Qualities.

Freshness, cleanliness, and flavour are the most desirable qualities in a good marketable egg, and there are few other products where value depends more directly on flavour and freshness than the egg.

When a fertile egg is exposed to a certain temperature, whether it be under a hen, in a hot kitchen, a warm store-room, or elsewhere, the embryo starts to develop, with the result that its flavour is soon spoiled.

It has been proved beyond doubt that the male bird has no influence on the number of eggs a hen will lay. The infertile egg will keep much better, therefore, unless the eggs are required for incubation purposes, there is no advantage in keeping males running with the flock.

The egg will very quickly take up or absorb objectional odours or mustiness, and for this reason care should be taken when eggs are being held for market to see that they are kept away from such materials as kerosene, paint, onions, fruit, &c.

### Mustiness.

Mustiness is one of the worst defects in an egg that a baker has to contend with, owing to the fact that it is almost impossible to detect the mustiness except by tasting it.

As the chief causes of mustiness are due to the egg being laid in damp straw, damp or soiled nests, or being forwarded to market in damp, soiled fillers, every care should be taken to see that plenty of dry, clean nests and nesting material is supplied, and that the eggs are collected at least once a day and sent to market in clean, dry fillers or containers. Experiments have proved that an egg kept in a temperature between 50° and 60° F. will be fresher at the end of three weeks than when kept in a temperature of 70° F. for a week, and for that reason the egg should always be stored in a dry, cool place.

### The Local Market.

The building-up of the poultry industry and placing it on a higher plane will depend, very largely, on the poultry-keeper, how he sends his eggs to market, and how he caters for his very best customer—namely, the local consumer.

Several years of supervising the grading of eggs for export has shown, as a rule, that the large producer who depends chiefly upon the sale of the commercial egg does send his produce to market regularly and in an attractive condition, but, unfortunately, a number of the more-or-less small producers, or, may it be said, the uninterested poultry-keepers, fail to give that little extra care and attention to the egg before sending it to market, and which has such an influence on the sale.

On one occasion while supervising the grading for export a consignment of 1,500 dozen eggs arrived at the export floor from country stores. After examining the contents of nine cases (225 dozen) it was found that owing to the soiled condition of many of the eggs only 20 dozen could be found suitable for export. The result was that the whole consignment had to be rejected and sold at a much reduced price, owing to the fact that it would not pay to grade such a line. Since then country store eggs have not been in demand for export purposes.

It was a pity to see such a consignment of good food, and one so uniform in quality when produced, sent to market in such a state, especially when the country egg, produced by birds kept under natural conditions, is of the very best quality when laid. Many small producers seem to think that because their output is small the few eggs that they send to market do not really count. This is a mistaken idea, for when it is remembered that the last census returns showed that of the 165,949 householders keeping poultry in this country, 134,140, or over 80 per cent. of the total, were keeping under twenty-five birds, and as a very large number of these householders sell eggs during the flush season, it will be realized that their collective output and the manner in which they are sent to market has a very big influence on the local price, also in creating the summer surplus.

### Export-trade.

During last egg export season some 338,430 dozen eggs were exported from New Zealand to the London market. This represents a very small percentage of the annual local consumption. Although the prospects of building up a big profitable egg-export trade are by no means bright, the economic importance of sending our small summer surplus overseas cannot be overestimated, for it is that surplus that often has the effect of bringing the local price down below the cost of production.

The export season is just at hand, and as this is a matter that concerns all producers it behoves all, both large and small poultry-keepers, who sell eggs to see that all eggs are sent to market in a fresh, clean, and attractive condition.

Some may think that the estimated consumption in this country of 300 eggs per person per annum is high, but the following may be of interest. The estimated consumption of eggs in Canada during 1920 was 202 per person. During 1921 the Canadian Government, at the request of those interested in the egg trade and with the hope of encouraging a greater consumption, introduced regulations whereby eggs before being placed on the local market had to undergo inspection. The result was that in five years' time the consumption of eggs in that country had gone up from 202 to 337 per head of the population, and now is over 400.

There are good grounds for assuming that if all eggs were sent to market in a clean and attractive condition, and they were a guaranteed fresh article when they reached the consumer, the consumption in this country would be much increased, with a consequent financial benefit to the producer.

### Eggs by Air-mail.

In order to test out the above method of transport, this Department arranged with the High Commissioner for New Zealand in London, and on 23rd May a box containing fifteen White Leghorn eggs from England was sent forward from Southampton Airport. The eggs

arrived in Wellington on the 15th June, and were taken to this Department's Poultry Station at Wallaceville. Eight of the eggs were placed under a hen, and the remainder in an incubator. At the end of fourteen days there were sure indications that none of the eggs would hatch.

The experiment, although interesting, would indicate that it is not possible at present to get results from hatching eggs when sent so far by air-mail.

*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

# THE APIARY.

### Breeding.

Colonies in normal condition should now have a good quantity of sealed brood in the combs, with young bees emerging every day. The queens will be laying well, though not up to their full capacity, but their powers in this direction will increase with the approach of warmer days. The first bees bred this season will be acting as field-bees, and the older autumn-bred ones will be dying off rapidly. Breeding should be kept going steadily without a break, as it is necessary that each colony should grow in strength in order to be in a condition to take advantage of the first flow from the early nectar-secreting plants.

Food and warmth are the main factors in promoting steady breeding, and these should have constant attention. It is well to remember that when breeding is in full swing a considerable amount of food is used up every day for the feeding of the brood. All through the spring, when weather conditions are favourable, some nectar can be gathered, and often a good deal is stored, which helps to supplement the stores in the hive. However, there are times when, through bad weather, the bees are unable to do this. Where such conditions last several days the food-supply will diminish rapidly, and the bees may be reduced to starvation before the beekeeper is aware of their condition. August and September are critical months in this respect, and if a spell of bad weather is experienced it is well to ascertain the condition of the food-supply in each hive, and feed without delay where necessary.

### Hints to Beginners.

There are a few points which every beekeeper should bear in mind when starting an apiary. The stocks must be clean and in good condition. No beekeeper can hope to succeed with poor bees, and no one but a novice would tolerate other than strong colonies. The hives should be well made and painted. Cracks and knot-holes may be of use for ventilation in the summer, but at any other time of the year they absorb much of the bees' time in gathering propolis to stop the draughts. Moreover, any holes except the entrance offer an inducement for robbers to investigate, and necessitate the bees employing extra guards to prevent attack. A careful watch should be kept on the stores, so that the bees may not starve. It is far better to overfeed than underfeed, for, as already indicated, it is amazing how quickly a colony will deplete its stores when brood-rearing commences in the spring. More feeding means more brood ; but, once commenced, it must be continued until the hives show actual proof that they are gathering sufficient nectar to keep themselves going. Feed only in the evening, inside the hives, and use a syrup in the proportion of two parts water to one part sugar ; dissolve thoroughly and feed as soon as it has cooled sufficiently to be harmless to the bees.

Provide permanent shelter. A live hedge is the best, if kept trimmed to a height of 8 ft. or 10 ft. Failing this, some kind of breakwind is essential.

The hives should never be exposed to high winds, as, in addition to the danger of the roofs being blown off, cold draughts check brood-rearing to a very great extent.

Open the hives only on warm, still days. Make necessary observations as quickly as possible, and take a note of them at once. The inside of the cover makes a good rough diary, and does not get lost or mislaid ; mark the date of each examination. Endeavour to distinguish the sex of the brood at a glance, and keep a sharp lookout for the queen , she is easily distinguished by the length of her body and the comparative shortness of her wings. Try to make a rough estimate of the weight of each frame as you lift it, comparing it in your mind with that of an empty comb, thereby arriving at some idea of the quantity of stores in each hive. Do not try to run many hives until the rudiments of the business have been grasped, but be content with one or two strong colonies until the learner's stage has been passed.

— *E. A. Earp, Senior Apiary Instructor, Wellington.*

# HORTICULTURE.

## Vegetable Crops.

WITH most of the early crops under way consideration is now given, during the month of September, to the planting and sowing of main crops, such as potatoes, turnips, salsify, carrots, peas, leeks, lettuce, spinach, and also salads , towards the end of the month sowing Brussels sprouts, savoy, cauliflowers, and celery for December planting. These operations, together with the preparation of the land so soon as it is available for planting out half-hardy crops towards the end of October or beginning of November, makes this season a busy time in the garden when the interruptions of stormy intervals are taken into consideration. Where the land is heavy or the drainage indifferent so that drying is slow the management often has a trying time.

In the June number of this *Journal* the names and addresses of seed-potato growers receiving provisional certificates for the crop were published. The acreage of seed of each kind indicates the outstanding popularity of the main-crop varieties Aucklander Short Top and Dakota, the former being an easy favourite. The Aucklander Short Top is a selection from Sutton's Supreme made by a grower in Kaiapoi and introduced into commerce in 1910. A further selection of the same origin made a few years later is known as Aucklander Tall Top. It is one the heaviest croppers, but later in ripening ; and, although the tubers are somewhat similar, they have not the quality of the Short Top. Dakota was produced in America some years ago. Its red, oval shape and good keeping and cooking qualities are well known. Other main-crop varieties well represented among the certificated seed crops are Arran Chief, King Edward, Inverness Favourite, and Arran Banner. Light cultivation is given during fine weather, after planting potatoes and before germination has taken place, so soon as a crop of seedling weeds makes its appearance or a crust forms on the surface of the land. The crop may be harrowed lengthwise with the rows without injury until the plants are well above the ground. This attention will save a great amount of hand-work. After the plants are well above the ground the first cultivation given is deep and carried close up to the plants. Later it is shallower and farther away with a view to avoiding injury to the roots.

A culinary turnip of excellent flavour, keeping quality, and early maturing is Purple Top or Early Milan. In districts where the season is too short for sowing an autumn crop of carrots a main crop of a

good intermediate variety is usually sown towards the end of the month of September—they are then in better condition for use in winter than if sown earlier. Fresh green peas in the spring are something of a luxury, as they may only be grown on limited areas in select localities; an early crop in bigger supply is available about the month of December and is very popular. Later the supply often falls off rather quickly, and this can be avoided by sowing at intervals up to the month of December inclusive. For planting out in January on land from which an early crop has been taken a sowing of leeks should be made now. The crop is hardy and little troubled with pests, it is a winter crop of the greatest utility, and is most useful and agreeable if grown to a moderate size only. New Zealand spinach is found growing wild on our light coastal lands. For use in summer when a supply of good, clean, green vegetables is often scarce it should be more often planted in the garden. It is not easily packed for the market, but for home use it is quite suitable and will satisfy the most critical tastes. To obtain early plants it is sown now in boxes in a frame for planting out towards the end of October, but otherwise it requires little attention if given a warm position. Silver beet is another vegetable of this class which may be sown now where summer cabbage of satisfactory quality is difficult to grow.

Plants of the cabbage family will now be subject to the attack of white butterfly larvæ and other pests, but satisfactory protection is afforded by dusting the plants lightly with derris, an extract from the roots of a tropical plant. It may be obtained from any seedsman, and is best obtained fresh, as it is inclined to depreciate if carried over into a second season. This material is non-poisonous and is preferable to arsenate of lead as a remedy for these pests when attacking plants of the cabbage family.

In growing celery it is to be remembered that one is dealing with a marsh plant—that is a plant requiring an abundance of humus and water. The land, however, must be well drained so that the water is not in the least stagnant. For commercial cropping the land should be naturally light, rich, and moist, or there should be good facilities for irrigation. Where the land is inclined to sometimes dry out the crop is planted in trenches. The September sowing may be made outside on suitable land. Broadcast a light dressing of superphosphate and maintain a clean fallow sufficiently long to destroy weed seeds, and then sow in drills a few inches apart. Mulch lightly with well-decayed manure and water well with a fine spray. When the plants are about 3 in. high they should be " wrenched " by cutting the tap root a few inches beneath the surface of the ground, using a bright sharp spade or similar implement. This is best done in dull weather when rain is threatening.

### Small and Sundry Fruits.

Established brakes of hardwood plants of this class will require light cultivation to suppress weed-growth and work in any artificial fertilizers that may be necessary to supplement the winter dressing. It is important the cultivation should be light, as any disturbance of the roots at this season will seriously interfere with growth and cropping. As regards fertilizers, the potash requirement should not be overlooked, especially for gooseberries, red currants, and raspberries; it improves the quality of both the wood and the fruit. Where plantations are approaching the end of the term of their useful life plans should be made for new plantings to be made on fresh land next season where a similar crop has not been grown during the past three years. Planting of this class to be done during the present season should be completed without delay, giving careful attention to pruning. Young raspberry canes, planted this season, should now be cut back to a length of about 8 in. to encourage strong sucker-growth.

Culinary and dessert fruits usually planted out during the month of October include tomatoes, passion-fruit, tree-tomatoes, Cape-gooseberries, melons, cucumbers, and—during the month of November—peppers and egg-plants. Most crops of this class require a light, rich soil in a warm, sheltered position. In many instances the land to be planted is at present occupied with a winter or spring crop such as cabbage, but the preparation of the land should be commenced promptly so soon as the present crop is cleared so that it may have time to settle and cleaning may be done. In deciding on a formula for manuring the present condition of the land must be taken into consideration. For instance, where a generous dressing of organic manure has been applied for the previous crops and a tomato crop is to follow, phosphates and potash will be the main requirements, while if the supply of nitrogen in the land is inclined to be high the amount of potash applied may be increased proportionately. Most of the plants mentioned will have been raised under glass and require to be gradually accustomed to outside temperatures and other conditions before planting out. This operation, known as " hardening off," must be done with consideration to avoid a serious check in the growth of the plants. It generally takes about a fortnight, during which time the plants are placed in a frame with a well-sloped canvas cover which can be used during hard weather. It is done most successfully when the plants have been grown steadily from the commencement and given air at every reasonable opportunity.

## The Homestead Garden.

In most districts the present time is the peak of the planting season for both hard-wooded plants—trees and shrubs and for softwoods—and hardy herbaceous perennials. For most kinds planting is best done now when the land is sufficiently dry In readiness to take advantage of such opportunities the plants should be obtained and heeled-in in friable soil in a convenient position. Most kinds of hard-wooded plants should have the branches thinned out and shortened well back to " outside " buds after planting. This is done with the greatest consideration with a view to obtaining a well-spaced, strong framework, of the desired design, quickly. When setting out young trees especially, planters often lack the courage to prune sufficiently hard. Exceptions in the treatment of young plants of this kind are climbing hybrid trees and perpetuals, and varieties of the class Pernetiana. These are thinned out moderately and shortened back lightly.

Among the hardy herbaceous perennial plants set out now consideration should be given to violet varieties and species of helleborus which have provided a welcome display of blossom during the winter months. Both require a rich, moist soil that does not dry out in summer. The hellebore species are chiefly natives of Balkan countries and thrive best in shaded positions. The month of September is a suitable time for repotting most kinds of house plants that may require it. It is important to make the soil rich and light by mixing with good, fresh loam a generous amount of humus in the shape of leaf-mould or thoroughly decayed manure and sharp sand ; this is best done at least some days before it is used.

Where new lawns are to be made by seeding or turfing the work should be completed as soon as weather permits. It is most urgent in localities where a dry summer season is sometimes experienced. As stated before, the surface should not only be smooth, but it should be of correct height and graded in such a way as to dispose of surface water in a satisfactory manner. Adjustments of this kind must not be hurried, but completed satisfactorily before laying turf—or sowing seed—during a period when there is no wind.

The high condition of sports greens, subject to frequent rough usage, is only maintained by constant attention and feeding. Although it is not always realized it is a fact that a good lawn is one of the most important features in the garden. A close, fine turf is very attractive and makes the best setting for buildings, trees, and shrubs in the vicinity. Fenced

off from grazing stock and closely cut, the plants making up the turf are soon short of nourishment, and weeds find an easy footing. The desirable turf condition is only maintained by supplying suitable manures and fertilizers. A lawn on light land requires liberal dressings of organic manures during autumn or spring—sometimes at both seasons. These should be in a finely divided state to facilitate even distribution. Most lawns, however, are greatly improved by dressings of sulphate of ammonia and sulphate of iron during the spring-time and superphosphate in early autumn. The spring-time dressing should now be given after the larger perennial weeds, such as rib-grass and cats-ear, have been removed. It may be composed of three parts sulphate of ammonia and one part of finely ground sulphate of iron by weight and applied on two or three occasions at monthly intervals at the rate of 1 oz. to the square yard. It is most convenient to mix the fertilizers with about five parts of fine, dry sand or old potting soil.

*Wm. C. Hyde, Horticulturist, Wellington.*

# ANSWER TO INQUIRY.

**IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.**

## GROWING OF LUCERNE.

E. A. M. L., Dannevirke :—

In November, 1936, I sowed some lucerne, using 8 lb. of seed per acre. A neighbour of mine had used this amount with success, but I found it insufficient. The lucerne plants that did spring up had rather a bad time with the sorrel, and later with Californian thistle and grass. I ploughed the area, which was in grass, to a depth of 8 in. in early July, worked it up very thoroughly, and in October put on a ton of lime (carbonate) per acre. A fortnight later I added 5 cwt. of superphosphate per acre, and worked it into the ground, and again a fortnight later, early November, I drilled in the lucerne-seed (7 in. drills) after having mixed it with culture supplied by the Department of Agriculture. At the time of sowing I used 2 cwt. of blood and bone manure per acre.

I have fenced the area, which required over 500 yards of fencing, and have planted Lawsonianas all round the paddock, so I am most anxious, having gone to this expense, to have a stand of lucerne. The soil is naturally well drained and should be ideal for growing lucerne. I am afraid the Californian thistle will become worse with further cultivation. Will you please advise me as to the best course to take now, giving me full details.

Fields Division :—

The general preparation and manuring appears to be satisfactory ; the mention of sorrel and grass, however, would indicate a seed-bed tending to be loose and open, and the use of a roller on the plough furrow before disking and again on the seed-bed before sowing would assist in getting a good take of lucerne, which likes a clean and firm seed-bed. 8 lb. of seed per acre is generally considered too light a sowing. From 16 lb. to 20 lb. is the general practice to ensure a sufficiently dense cover of young lucerne to compete with weeds. Owing to the liability of damage to the culture, it is not advisable to use a nitrogenous manure such as nitrate of soda or sulphate of ammonia, or an organic fertilizer such as blood and bone, with the seed. Blood and bone is also liable to affect germination under some conditions. The improvement of a poor stand, particularly under the conditions indicated in your letter, is a difficult problem, and one best discussed on the area. Surface-sowing of more seed after cultivation is generally unsatisfactory, as the young seedlings are smothered by the older lucerne-plants, and by weeds; which it is often impossible to eradicate.

# WEATHER RECORDS: JULY, 1937.

Dominion Meteorological Office.

## NOTES FOR JULY.

THE cold weather, with a prevalence of southerly winds which had characterized June, persisted through the first eight days of July, but thereafter weather of a more westerly type prevailed and conditions were definitely milder. Towards the end of the month some beautiful days were experienced in most places. Rainfall was generally much below and sunshine above average, but nevertheless the weather during the month was rather unsettled and, except in eastern districts, more especially in the South Island, rain, though often light, was rather frequent. Over western and central districts of the North Island the soil was continually damp and muddy, and conditions on the farms were unpleasant. There was little growth of vegetation. In Canterbury and Marlborough, on the other hand, it was possible for some arrears in agricultural operations to be made up in numbers of places. The area under crop is, however, likely to be considerably less than during last year. Stock, except hoggets, are reported as doing well, but a spell of dry and sunny weather would be welcome. Early lambs have appeared in numbers of districts, and so far the losses have been light.

*Rainfall.*—Except in comparatively small and isolated areas the rainfall was much below normal. In Marlborough and Canterbury the totals were particularly low.

*Temperatures.*—Temperatures were almost everywhere below normal, though the departures nowhere amounted to 2° F.

*Sunshine.*—Though below it at a few places, more especially on the west coast, sunshine was generally considerably above average.

*Storm Systems.*—On the 1st a cyclonic depression was centred over North Auckland. Easterly gales blew in the far north and south-easterlies in Taranaki. There were some heavy rains in northern districts. By the 3rd the depression had moved away and an anticyclone had enveloped the Dominion. The centre was, however, far to the south, and cold southerly winds persisted.

On the 5th a depression, with a considerable extension in the south-to-north direction, advanced from the Tasman Sea and crossed the country during the night. On the 6th strong south-westerly winds were blowing. This storm caused general rains. Snow was widespread in the South Island and reached low levels on the mountains in the North. Some very severe frosts followed.

From the 9th to the 17th there was another unsettled spell. This began with a series of westerly depressions, but from the 14th an intense anticyclone covered Australia and extended over the Tasman Sea, while several depressions followed each other on a southerly course off the east coast of New Zealand. Southerly gales blew on the 16th to 17th. Snow again fell to low levels on the ranges, while there was hail and thunder in many places.

The improvement which followed was only brief, and between the 19th and the 22nd another series of depressions passed. Some heavy rains fell in western districts. There was considerable thunder and hail on the 22nd, and two men were struck by lightning near Otorohanga.

An anticyclone covered the Dominion on the 23rd and 24th, but westerly depressions were soon again following each other across the South Island. There was heavy snow on some of the ranges on the 27th, and hail and thunder were reported for the third time during the month. The last three days saw a considerable improvement.

RAINFALLS FOR JULY, 1937, AT REPRESENTATIVE STATIONS.

| Station. | Total Fall. | Number of Wet Days. | Maximum Fall. | Average July Fall. | Total Rainfall to Date. | Average Rainfall to Date. |
|---|---|---|---|---|---|---|
| | | | *North Island.* | | | |
| | Inches. | | Inches. | Inches. | Inches. | Inches. |
| Kaitaia .. .. | .. | .. | .. | 5·48 | .. | 33·64 |
| Russell .. .. | 4·56 | 13 | 2·37 | 6·72 | 68·28 | 37·34 |
| Whangarei .. .. | 5·62 | 23 | 1·18 | 7·19 | 57·37 | 38·79 |
| Auckland .. .. | 4·23 | 25 | 1·21 | 5·58 | 30·22 | 29·86 |
| Hamilton .. .. | .. | .. | .. | 5·10 | .. | 29·00 |
| Rotorua .. .. | 2·44 | 14 | 0·86 | 5·00 | 30·88 | 31·85 |
| Kawhia .. .. | .. | .. | .. | 6·01 | .. | 31·55 |
| New Plymouth .. | 6·51 | 23 | 1·18 | 6·38 | 38·59 | 34·02 |
| Riversdale, Inglewood .. | 8·96 | 20 | 1·82 | 10·06 | 60·55 | 58·71 |
| Whangamomona .. | .. | .. | .. | 7·27 | .. | 42·97 |
| Hawera .. .. | 3·88 | 17 | 0·71 | 4·22 | 26·62 | 25·61 |
| Tairua .. .. | 6·77 | 17 | 1·53 | 6·31 | 37·48 | 39·87 |
| Tauranga .. .. | 3·57 | 17 | 1·34 | 4·94 | 33·68 | 31·82 |
| Maraehako Station, Opotiki | 8·38 | 13 | 2·53 | 4·45 | 40·02 | 32·24 |
| Gisborne .. .. | 3·66 | 15 | 0·79 | 5·05 | 22·74 | 29·96 |
| Taupo .. .. | 2·29 | 12 | 0·84 | 3·87 | 20·60 | 25·23 |
| Napier .. .. | 3·27 | 11 | 1·45 | 3·27 | 14·84 | 19·35 |
| Hastings .. .. | 2·03 | 10 | 1·15 | 3·66 | 11·44 | 20·29 |
| Taihape .. .. | 2·36 | 19 | 0·50 | 2·97 | 20·02 | 20·78 |
| Masterton .. .. | 4·28 | 17 | 1·30 | 4·18 | 21·06 | 22·95 |
| Patea .. .. | 2·83 | 19 | 0·66 | 4·23 | 27·16 | 25·63 |
| Wanganui .. .. | 1·22 | 11 | 0·25 | 3·34 | 20·31 | 21·04 |
| Foxton .. .. | 0·78 | 7 | 0·30 | 3·11 | 13·00 | 18·38 |
| Wellington .. .. | 3·93 | 16 | 0·81 | 4·85 | 22·59 | 25·74 |
| | | | *South Island.* | | | |
| Westport .. .. | 8·46 | 17 | 1·86 | 8·30 | 50·64 | 54·80 |
| Greymouth .. .. | 8·23 | 21 | 2·05 | 7·93 | 64·33 | 57·49 |
| Hokitika .. .. | 7·28 | 20 | 1·82 | 8·96 | 66·90 | 64·05 |
| Ross .. .. | 5·65 | 14 | 1·35 | 9·18 | 77·29 | 71·95 |
| Arthurs Pass .. .. | .. | .. | .. | 9·93 | .. | 85·87 |
| Okuru, South Westland | 12·69 | 9 | 2·20 | 10·52 | 91·30 | 82·56 |
| Collingwood .. .. | 6·35 | 10 | 2·40 | 9·40 | 53·82 | 54·96 |
| Nelson .. .. | 3·40 | 8 | 1·12 | 3·48 | 22·01 | 21·80 |
| Spring Creek, Blenheim | 1·18 | 8 | 0·42 | 3·42 | 15·95 | 17·89 |
| Seddon .. .. | 0·72 | 7 | 0·31 | 2·40 | 14·02 | 14·72 |
| Hanmer Springs .. | 2·57 | 10 | 0·61 | 4·29 | 20·32 | 26·06 |
| Highfield, Waiau .. | 1·18 | 6 | 0·33 | 3·34 | 13·47 | 30·08 |
| Gore Bay .. .. | 1·34 | 9 | 0·31 | 2·80 | 20·26 | 18·67 |
| Christchurch .. .. | 1·91 | 8 | 0·93 | 2·54 | 14·71 | 15·17 |
| Timaru .. .. | 0·37 | 6 | 0·15 | 1·84 | 13·60 | 12·98 |
| Lambrook Station, Fairlie | 0·69 | 7 | 0·33 | 2·62 | 12·30 | 14·60 |
| Benmore Station, Clear-burn | .. | .. | .. | 1·74 | .. | 14·54 |
| Oamaru .. .. | 0·56* | 6 | 0·29 | 1·72 | 10·49 | 12·70 |
| Queenstown .. .. | 1·39 | 12 | 0·67 | 2·03 | 18·67 | 17·38 |
| Clyde .. .. | 0·24 | 3 | 0·12 | 0·90 | 10·37 | 8·66 |
| Dunedin .. .. | 1·59 | 13 | 0·31 | 2·98 | 28·16 | 21·06 |
| Wendon .. .. | 1·64 | 11 | 0·32 | 1·74 | 29·34 | 17·22 |
| Balclutha .. .. | 1·46 | 11 | 0·49 | 1·78 | 23·18 | 14·49 |
| Invercargill .. .. | 3·48 | 19 | 0·60 | 3·27 | 28·31 | 26·58 |
| Puysegur Point .. | 7·93 | 24 | 1·07 | 6·15 | 56·23 | 48·41 |
| Half-moon Bay .. | .. | .. | .. | 4·40 | .. | 33·53 |

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## MANCHURIAN RICE GRASS (*ZIZANIA LATIFOLIA*).

### ITS OCCURRENCE AND DISTRIBUTION IN THE NORTHERN WAIROA DISTRICT.

E. H. ARNOLD, Instructor in Agriculture, Dargaville.

WHEN numerous ships were engaged in transporting from North Auckland the large quantities of both white-pine and kauri timber, many arrived in ballast, which usually consisted of soil loaded at the last port where cargo was discharged. On arrival in the Northern Wairoa, the ballast was indiscriminately dumped along the banks of the river. From such ballast dumps, deposited from a ship which, according to early settlers, arrived from South Africa some thirty or forty years ago there spread and naturalized itself along the river-banks an exotic plant. This plant is called locally jungle grass, South African grass, reed-grass, rice-grass, or elephant grass. Recently, owing to its spread along the soft mud of the tidal-river banks, following up and blocking watercourses and drains, gradually working its way into damp or swampy places, and slowly encroaching on flat pasture land bordering the Northern Wairoa River, it has caused concern among the farmers whose land is adjacent to the river-banks. This plant has been identified by Allan(1) as Manchurian wild rice (*Zizania latifolia*), and is a native of Asia. He further states that in China the thickened bases of the stems are sold as a vegetable, and are said to have a fine flavour.

Manchurian wild rice is a very tall-growing grass, with the stems and leaves reaching a height of from 6 ft. to 10 ft. It possesses a strong deep rooting-system and far-reaching rhizomes. In the soft river-banks the thick roots penetrate several feet into the soil. It also has the undesirable habit of sending roots and rhizomes down under drains and trenches which have been dug to prevent its spread, and throws up suckers or new plants on the other side of the trench. In some places it is found growing on the roadway, the suckers having broken through 10 in. to 12 in. of road-formation. During the winter little or no growth occurs. The old leaves, particularly where exposed to severe winds, begin to die off, but the remainder of the plant remains fresh and green. About September fresh green growth is produced throughout the area of the grass, and, if soil conditions are wet enough, new shoots from rhizomes are given off for a distance of usually up to 3 ft. on the land side of the affected area. However, the extent of

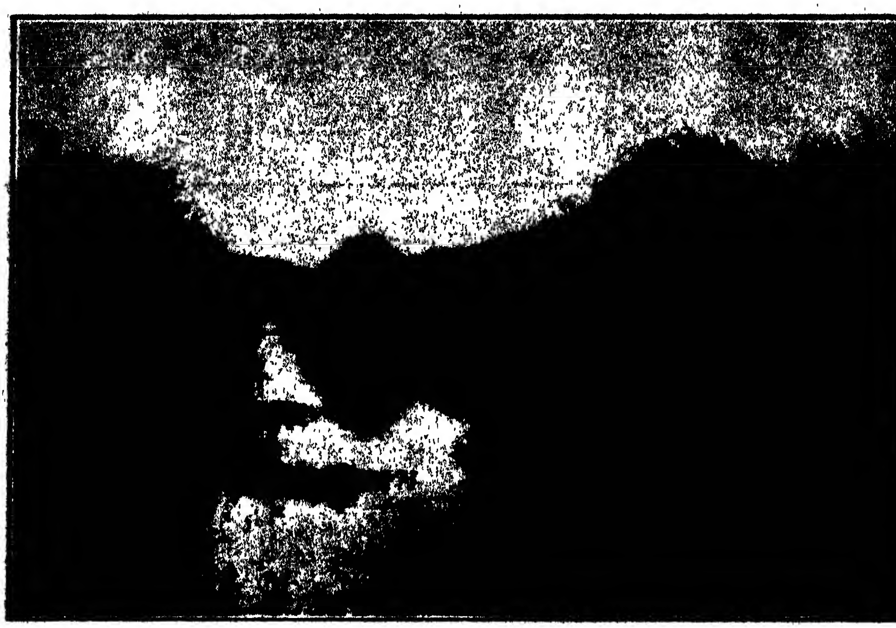

FIG. 1. MANCHURIAN WILD-RICE GRASS (ZIZANIA LATIFOLIA), GROWING ON BOTH SIDES OF A DRAIN AT ARATAPU.

In some cases the grass will form a complete belt on each side and eventually block the drain.

FIG 2. CLUMPS OF MANCHURIAN WILD-RICE GRASS SPREADING INTO SOFT WET PLACES IN A FIELD.

Note small plant in the foreground. This has suckered from the large patch on the left The photograph was taken near the drain shown in Fig. 1.

spread along the softer river-bank is considerably greater. During late November or early December, flowering-stalks, which carry in a panicle the female flowers above and male flowers below, are sent up within 8 ft. to 10 ft. of the outside wall of the grass. The plant is an irregular seeder, but in some seasons quite a fair amount of seed has been produced. When ripe the seed falls and is carried both up and down the river by the regular rise and fall of the tide. If floods occur, the seed may be deposited on pasture land, where it quickly germinates, and new centres of growth are established. From single plants derived from seed or portions broken away from established plants, the grass spreads to other areas along the river previously free of Manchurian rice-grass. At Hoanga there is a patch of approximately 1½ square chains, which has during the last fifteen years, despite several cuttings and burnings-off, spread from a single plant. On the opposite side of the river at Awakino Point rice-grass has encroached over a stop-bank, under and across a drain and out into a field, apart from the stop-bank and drain, a distance of 21 ft. in the past four or five years. In general, however, the spread inland may not exceed 2 ft. or 3 ft. each year. By such methods, from the various centres of establishment, the patches grow into continuous belts, which in some cases are up to 2 chains in width along the river and creek banks.

The Manchurian rice-grass extends over a distance of some twenty-five miles along the banks of the Northern Wairoa River. Small areas occur up the Naumai Creek, and from there, up the Northern Wairoa River, intermittent patches are present on both banks to within a few miles past Tokatoka. From there, particularly on the western bank, more or less continuous belts up to 2 chains in width occur. It has penetrated varying distances up side creeks and drains. It exists over approximately one mile along the banks of the Aratapu Stream, and belts of differing sizes are to be found for a distance of four and a half miles up the Kaihu River. The widest belts are found about half a mile above the bridge at Dargaville, round Awakino Point, and on the opposite banks at Hoanga. From there up the river it grows in belts and areas of varying sizes to within a short distance of Pukehuia.

Several factors appear to influence the rate of spread of Manchurian wild-rice grass. As the tidal effect becomes less in the river, the grass is stronger-growing, encroaches more rapidly on to good land, and causes more trouble through affecting stop-banks and blocking entrances to drains. Shade trees inhibit the growth and spread. On one farm, where such trees (pines) were planted some twenty or thirty years ago, there occurs a break in what is otherwise a continuous belt of rice-grass. Further, in some places, belts of New Zealand flax growing between the stop-banks and the water tend to hinder its spread into good grass paddocks. On farms where English grasses are in combination with paspalum, and where ample winter feed is provided by means of hay and silage, and also on partly drained farms with much roughage where stocking is not heavy, this grass is left alone by stock. However, on farms where winter feed is short or lacking stock will eat a small proportion of the shorter outside growth, and thus maintain some check on its spread. Here the grazing animals not only eat back the younger growth and tips of the longer, coarser, unpalatable leaves, but also make tracks through the grass areas and derive a considerable amount of shelter during the winter and early spring months when cold westerly

or south-westerly winds are common. Otherwise stock do not have a liking for the grass. It also appears that Manchurian rice-grass will not stand tramping by stock to any great extent. This would be effective only on the drier land, and not on the river side of stop-banks or on undrained areas.

As mentioned before, the slow insidious encroachment of rice-grass on to the good land is causing considerable concern and attention among farmers. Some do not give it much thought, and have a good word for it. These men are inclined to value it as a shelter for stock during the winter and early spring, and also claim that it assists to hold the stop-banks together. However, during an

FIG. 3. A BELT OF MANCHURIAN WILD-RICE GRASS ENCROACHING INTO A FIELD AT AWAKINO POINT.

The grass has spread from the river-bank on to the stop-bank over a drain and through the fence out into the pasture.

investigation, in some instances, it was found that where the grass grows densely along stop-banks, the formation, instead of remaining firm, has now become a mass of soft mud which does not dry out and then slowly flattens out to be washed away by the tidal current. Where it only possesses a strip of the river-bank, and conditions do not allow of its spread inland, it is no doubt valued as a winter feed for dry stock, especially bulls and yearlings. Here little or no winter supplementary feed is available, and its value arises through poor farming methods. Where the grass does cause trouble, interfering with the efficient working of drainage systems and encroaching into pastures, may methods of control and eradication have been attempted. Burning during dry spells was no doubt the method which most readily recommended itself. Even if what might be called a good "burn" occurred there was always 2 ft.

or 3 ft. of the more open and shorter growth left unburnt round the outside. The face of the area was left free to extend, while fresh vigorous growth soon commenced over the burnt area. Use of the flame-thrower has been made. The first burning requires considerable treatment, and, as in the case of ordinary burning, the regrowth is very rapid. Further treatments of the regrowth will probably be necessary, thus making a control which is of questionable value, expensive, and not likely to be really effective for general adoption. Cutting, particularly in the soft mud is difficult and costly. Further, it appears to only prune the plants, which recommence growth with renewed vigour. Some farmers who cut small areas utilize the bundles of leaves for laying in roadways which become muddy through continual traffic of stock. This assists for a short time, but produces odours which are objectionable, especially if the filling is near a milking-shed. In other cases the long leaves are cut and used for the thatching of haystacks. The leaves being long and bulky are much more easily and quickly built on to a stack than are ordinary rushes. The rain-water is readily shed and the thatch lasts until the stack is utilized.

Taking into account the nature and spread of Manchurian rice-grass, as well as the fact that the more common methods of control have failed, the position really becomes most difficult. Eradication does not appear to be possible. Control of the present areas, together with the prevention of its further spread, must therefore be the consideration. The suggestion which offers itself is to make some attempt to confine the grass to those areas upon which it is growing at present. This would necessitate the planting of suitable evergreen shade trees, 5 ft. or 6 ft. inside of the present line of the grass. Trees tolerant of wet conditions would have to be selected. Fencing would be necessary. This, together with the land abandoned as useless, and the area occupied by the shade trees, would make the control expensive. If flood-water causes fresh centres of the grass to be established inside the line of trees, these new plants should then be immediately treated by spading, or by cutting and maintaining the growth constantly at a stage to be eaten by stock. Except for small areas, such as the outlets of drains, chemical methods of treatment are to be considered a waste of time.

(1) ALLAN, H. H.: An Introduction to the Grasses of New Zealand. Bulletin No. 49, Dept. of Scientific and Industrial Research.

The necessity of sowing fertilizer with turnips is well illustrated in the four turnip-manuring trials in the Christchurch district. In each trial one or two drill strips were sown without manure, and these plots are less than one-third as well grown as plots which received super and lime (4 cwt. per acre), reverted super (249 lb. per acre), super and blood and bone (2 cwt. per acre), or proprietary manure (2 cwt. per acre). —*Fields Division.*

In a paddock of rape in Eastern Southland part of the crop was sown broadcast and part of it was sown in ridges. The crop on the broadcast section is poor and stunted, while that on the ridged section is good and vigorous. The quantity of fertilizer applied was the same on both blocks, but the scuffling and inter-cultivation on the ridged rape has made the comparative differences.

—*Fields Division.*

# THE AVOCADO.

## CULTURE IN NEW ZEALAND.

P. EVERETT, Orchard Instructor, Gisborne.

THE avocado is a tropical or semitropical fruit that was little known in temperate zones until a quarter of a century ago. Since that time rapid progress has been made in the cultivation of this fruit in temperate climates. The name "avocado" is now applied to this fruit in all English-speaking countries, while in certain foreign countries the fruit is known as the "alligator pear."

### INTRODUCTION TO NEW ZEALAND.

So far as can be ascertained, the first avocado-trees of known varieties to become established in New Zealand were imported by the Department of Agriculture in the year 1919, and were planted in what was then the Government Horticultural Station at Tauranga, which is located in latitude 38° S. In later years numerous trees were raised from seeds which were imported, and a few of these trees are now bearing fruit. Many other trees have been raised from the seeds of one of the trees at Tauranga, which commenced to bear fruit at an early age. In addition to the foregoing, trees comprising thirteen different named varieties were imported and established at Wanganui.

### DESCRIPTION.

The avocado belongs to the genus *Persea*, a member of the Laurel family, to which belong also such economic plants as camphor and cinnamon. The cultivated species of the genus are native of Mexico and Central and South America. They are divided into two distinct species,* *P. americana* and *P. drymifolia*; the former includes all varieties horticulturally grouped in the West Indian and Guatemalan races, and is commonly known as the Guatemalan species. *P. drymifolia*, known as the Mexican species, includes the small-fruited varieties of the Mexican highlands. Both species are represented in the cultivated varieties. The Mexican species can be distinguished from the Guatemalan by the very pronounced anise odour that can be detected in the leaves and young growth of the former when crushed; this odour is entirely lacking in the Guatemalan species.

The tree is evergreen and has a spreading habit, the height usually approximating the spread. The largest tree in New Zealand is reported to have attained a height of 35 ft. Seedling trees are inclined to be more upright than when budded. The leaves may be oval, elliptic, or lanceolate; their base is usually acute or truncate; the apex varies from blunt or acuminate; the length is reported (Hodgson) to vary from 3 in. to 15 in., but, as observed in New Zealand, is approximately 6 in. to 8 in. The colour is bright green; young growth is generally bronze.

* R. W. Hodgson, Associate Professor of Subtropical Horticulture, University of California. "Californian Avacado Industry." Circular No. 43 (April, 1930). Issued by the Californian Agricultural Extension Service.

The flowers are small and usually of a yellowish colour. They are borne on terminal racemes, possessing both stamens and pistil. Various reports from overseas authorities indicate that the fruit of the cultivated species are extremely variable in size, shape, colour, and other characteristics, varying in size up to over 3 lb. In shape they may be round, oval, pyriform, or any of the numerous gradations between these forms. The colour ranges from light yellowish-green, through dark green, maroon, brown, and reddish-brown, to purplish-black. The skin is thin and membranous in *P. drymifolia*, while in *P. americana* it is thick and tough, varying greatly in different varieties.

The fleshy, edible part, lying between the skin and the seed, is of a buttery consistency, cream to bright yellow in colour, often greenish near the skin. Each fruit normally contains a single large seed. The seed is inverted in the fruit so that the base is on the side away from the stem. Most, if not all, of the fruits produced in New Zealand are pyriform or between pyriform and oval in shape and vary in length from about 2½ in. to 5½ in., with a maximum diameter of approximately 3¼ in.

This savoury fruit has a nut-like flavour, and is most commonly used either as a green salad ingredient or, when mashed and seasoned, as a sandwich filling. It can also be served on plain biscuits or on toast.

### Nutritive and Dietetic Values.

The composition of the avocado is remarkably different from other fruits used in the fresh state. It has been shown by various overseas workers (R. W. Hodgson) that its average protein content (2·1 per cent.) is approximately three times that of the ordinary fresh fruits. Whereas most fruits contain little or no fat, the average in the avocado is 20·6 per cent. The caloric or energy value of the edible portions of the commonly used fruits is low, ranging from a minimum of 175 calories to a possible maximum of 400 calories per pound. The average for the avocado, as determined by Jaffa and Goss, is 1,056 per pound, or two and a half times the maximum for the other fruits, and far in excess of that of lean meat. From these facts it is evident that this fruit contains nutritive values far exceeding those of other fresh fruits.

### Climatic and Soil Requirements.

The cultivated varieties of the avocado are subtropical fruits, and their culture is therefore limited to localities of relatively mild winters, such as are experienced in the warmer coastal regions of the Auckland Province. Observations on the behaviour of the avocado in New Zealand, supported by evidence from overseas countries, indicates that it will thrive on a wide range of soils. The character of the subsoil is perhaps of the greater importance, since perfect drainage and an absence of impervious clay or hard pan for a depth of 3 ft. or more appears to be imperative. Evidence in support of this belief lies in the fact that several dozen seedling trees planted near Warkworth over an impervious clay subsoil

all failed to develop into mature trees. In general it can be taken that for the varieties of avocado generally cultivated the climatic and soil requirements are somewhat similar to those of citrus fruits.

### Propagation.

Like most other fruits, the avocado cannot be depended upon to reproduce true to type when raised from seed. Consequently, stocks are raised from seeds of hardy varieties, and when of sufficient size these are budded in the same way as citrus trees. While the operation of budding is a simple one, the results obtained are often disappointing, in that frequently many buds fail to take, even when the work is done by an expert operator.

### Particulars of Trees growing in New Zealand.

The four trees established at Tauranga, referred to earlier in this article, were planted in the year 1919. They consist of one tree each of the following four varieties: Lyon, Northrop, Harmon Abouacate, and Miserve.

*Lyon.*—This tree commenced cropping four or five years after planting, and has borne light to medium crops almost every year since that date. The tree is now about 35 ft. high. The fruit is small, weighing about 3 oz. to 4 oz. The seed is relatively large, and the flavour does not compare favourably with other varieties grown in New Zealand.

The other three varieties growing at Tauranga have blossomed profusely for many years past, but have never set any fruit. The variety Miserve is the only tree to be affected at all seriously by frosts, and consequently is much smaller than the other three trees.

*Fuerte.*—The only tree of this variety known to the writer is in a private garden at Feilding. The tree was budded on to a seedling stock, where it now grows, seven years ago. It has a height of 16 ft. and a spread of 10 ft. The tree has flowered profusely for several seasons past, but no fruit has set to date, unless during the present season.

Two trees of unnamed varieties were imported from Honolulu in the year 1929 and planted at Kerikeri, North Auckland. They attained a height of 14 ft. four years from planting. The trees were then cut back severely for the purpose of shifting to another position. They made a good recovery, and are now 9 ft. in height. No fruit has yet been produced.

Numerous seedlings of the Lyon variety have been distributed from Tauranga to various parts of the North Island. Most of these seedlings have met with little success, many having died a few years after planting. However, two of these trees, which are situated at Thames and are now ten years old, have in recent years commenced to bear fruit.

Two avocado-trees in New Zealand which have borne fruit, other than the Lyon variety, are in a commercial orchard at Ormond, near Gisborne. In this orchard there are four trees that were raised about twelve years ago from seeds imported from California, and of unknown variety. These trees have all made vigorous growth, and have never suffered to any appreciable extent from frost injury. One tree (hereafter referred to as No. 1) commenced to bear fruit eight years after planting, and another (No. 2) one year later. The other two trees have flowered profusely for several seasons without setting any fruit. The

soil in this orchard is a fertile clay loam, with good natural drainage. Another tree raised from the same consignment of seed is situated in a narrow valley about ten miles inland from Tolaga Bay, and has made poor progress on account of severe frost injury on numerous occasions.

*Tree No. 1.*—This tree is now bearing its fifth successive crop, the two heaviest crops being estimated at between fifty and eighty fruits. Most of the fruits matured to a suitable size for commercial use, being approximately 5 in. long with a diameter of $2\frac{3}{4}$ in., and pyriform in shape. The flavour is rich and aromatic; the seed is relatively small with a close-fitting seed cavity; and the colour of the skin when fully ripe is purplish-black. The harvesting period extends from the first week in October until the end of the year, and possibly later.

*Tree No. 2.*—During the 1933–34 season this tree brought to maturity some forty fruits, and only a few fruits in both the two previous seasons. It is slightly larger than and of a similar flavour and colour to the fruit borne on tree No. 1. The seed is relatively small, and the seed cavity close-fitting. The shape is between pyriform and oval. The season of ripening is not known exactly. However, fruits have been harvested in good marketable condition from early January until the end of August. The fruit of this tree is about three months later in reaching maturity than tree No. 1.

Tree No. 1 corresponds very closely with the description of the Fuerte variety (as supplied by R. W. Hodgson), and is probably a seedling of that most popular variety. Likewise, tree No. 2 is similar to the description given of the Puebla variety, and so is in all probability a Puebla seedling. These two varieties are reported to be planted for commercial purposes in the United States of America more extensively than any other varieties.

The trees of thirteen named varieties were imported by the late Mr. A. Allison and established in his garden at Wanganui. Most of these trees were introduced in 1925 and in 1927, although several years earlier he had raised a number of seedlings, and at least one tree was successfully budded with the Fuerte variety in 1923. In 1931 this excellent collection of varieties was reported to be making vigorous growth, very few trees showing any appreciable injury from frost. Varieties that flowered in the 1930 season were Fuerte, Puebla, and Northrop. So far as can be ascertained, none of these varieties set fruit. Following the death of Mr. Allison, the entire collection was sold by auction, buyers participating from various parts of the North Island. No further record of these trees is available.

A nurseryman reports having grown avocado-trees at New Plymouth which flowered for a number of seasons, but failed to set any fruit, and were later destroyed. It is not known whether these were seedlings or propagated trees of named varieties. It is also reported that seedling trees of the Mexican strain have been grown at a station on the Wanganui River for the past twenty-five years. Some of these trees have fruited, but the quality is said to be poor.

## Possibilities.

From the foregoing it appears that, while the trees of many varieties will withstand the winter temperatures experienced at least as far south as Feilding, latitude 40° S., it is only in the milder coastal areas of the Auckland Province that fruit can be expected to develop

on varieties suitable for cultivation. Moderate crops have been reported from Thames, Tauranga (latitude 38° S.), and Gisborne (39° S.). The only named varieties known to have been tried out in such warm areas are at Tauranga, and these, unfortunately, do not include the leading commercial varieties. The fruit is practically unknown in New Zealand at the present time, although small consignments are occasionally imported from California and the Pacific Islands. These fruits usually retail at prices ranging from 6d. to 1s. 6d. each according to quality.

It appears that there are commercial possibilities in the growing of this fruit in suitable localities in the northern portion of the North Island of New Zealand. However, there is need for much more work in the matter of testing the suitability of various varieties, soils, and locations before planting on an extensive scale is undertaken.

The writer wishes to express appreciation for the valuable information concerning avocado-trees in New Zealand kindly supplied by the following Orchard Instructors: Messrs. A. R. Grainger, Tauranga; L. Paynter, Auckland; and J. W. Whelan, Palmerston North. Also the late Mr. H. F. Frost, formerly Orchard Instructor, Masterton.

# CERTIFICATE OF RECORD.

THE Jersey cow Pukeroa Wheaten Wafer, bred and tested by Mr. F. Geck, Te Kauwhata, recently qualified for Certificate-of-Record in the 305-day division of the C.O.R. test on a production of 12,853·9 lb. milk containing 700·76 lb. fat, average test 5·45 per cent. She was 3 years 165 days old at date of calving for commencement of record, being born on 3rd September, 1932. The performance of Pukeroa Wheaten Wafer is the highest to date in the 305-day class, not only for the Jersey breed, but for all breeds participating in the C.O.R. test.

PUKEROA WHEATEN WAFER.

[N.Z. Farmer Weekly photo.

# IRRIGATION IN CENTRAL OTAGO.

## DUTY OF WATER.

G. G. CALDER, Instructor in Agriculture, Alexandra.

"DUTY of water" is the term used in defining the total amount of irrigation water used on the land to produce successfully any given crop. The duty of water is said to be high or low depending on the amount of water used. On a given soil type and crop a high duty of water is obtained under careful and efficient management or a low duty of water under careless and wasteful management where the consumption of water has increased.

FIG. 1. THE CROP OF UP-TO-DATE POTATOES GROWING ON THE LIGHT SANDY LOAM UNDER IRRIGATION AT ALEXANDRA

Since so many factors come into play when determining duty of water it is impossible to lay down any hard and fast rules regarding it. Apart from the different requirements of different crops there are large variations in the water-holding capacity of the soils and subsoils themselves.

It has been shown(1) that soils composed of fine particles—*i.e.*, clays and silts—can absorb and hold a definitely greater volume of water than soils composed of coarser particles such as fine gravels and sand. Consequently the latter type requires more frequent but smaller irrigations than the former. Further, the depth of soil, presence of a hard pan or an open gravel subsoil all necessitate using different amounts of water when irrigating to obtain a high duty of water.

With a good depth of soil a large volume of water can be used and the surface soil saturated: there is a downward movement of water, which, however, rises again by capillary action after the moisture near the

surface has been used. Where a pan is present smaller quantities of water must be used, otherwise one gets water-logged conditions of the soil. A gravel subsoil, while supplying ideal conditions for drainage, is also a natural sink into which all excess irrigation water is lost, as there is no return movement of this water by capillary action. Consequently, to get a high duty of water here, only sufficient irrigation water should be used to meet the current requirements of the crop or the water-holding capacity of the soil without penetrating into the shingly subsoil. In a previous article(2) the low duty of water is seen on the 52-acre farm mainly due to the fact that the shingly subsoil reaches, or is in close proximity to, the surface over a comparatively large area of the farm.

Evaporation from a wet-soil surface is much faster than from a free-water surface. The average loss from a free-water surface at Alexandra for the period of three years—1933, 1934, and 1935—is 31·7 in. per annum. Since a loss such as this is often as much as and sometimes more than the irrigation water applied to the land, some measure must be taken to conserve the irrigation water. A cereal, grass, or lucerne crop supplies a natural cover to stop excessive evaporation, but when a crop, such as potatoes, mangel, maize, or carrots is grown in drills, then the soil requires mulching. This mulching or loosening-up of the surface can be done with a cultivator or horse hoe: it retards the capillary movement of the moisture to the surface and to a large extent checks evaporation. At Galloway Experimental Area(3) it was found that where the ground had not received cultivation till eight days after irrigating the water lost by evaporation was in the vicinity of 2 in. On adjacent ground where surface cultivation had been carried out after irrigation the loss amounted in eight days to ½ in.

The size of the total irrigated holding is reflected in the duty of water. As shown in the previous article referred to(2), a small area can be irrigated more economically than a large one, provided the soil type is the same, inasmuch that a smaller head of water is required and the work of distribution can be carried out more effectively.

The system of irrigation used is also a big factor in determining whether the duty of water will be high or low, since some systems are more efficient than others.

## Rainfall for Six-monthly Period, October to March at Alexandra.

As can be seen from the following data, the average rainfall for each wet day was so light at Alexandra during the period specified as to be of practically no value to the land :—

| Season. | Rainfall. | Number of Wet Days. | Average Rainfall per Wet Day. | Annual Rainfall for Year ending 31st March. |
|---|---|---|---|---|
| | Inches. | | Inches. | Inches. |
| 1934–35 .. | 7·43 | 45 | 0·16 | 14·25 |
| 1935–36 .. | 5·16 | 51 | 0·10 | 9·28 |

The following table represents actual figures taken out on the duty of water over the past two seasons within a radius of five miles of Alexandra :—

| Crop. | Soil Type. | Area in Acres. | Method of Irrigation. | Number of Irrigations. | Volume of Water used for Irrigation. | Total Water used, in Inches per Acre. | Yield per Acre. | Duty of Water per Ton. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Inches. | | Inches. |
| 1. King Edward potatoes | Medium to heavy schist loam | 4·0 | Furrow .. | 4 | 2 cusecs for 24 hours | 47·5 | 13 tons .. | 3·6 |
| 2. King Edward potatoes | Medium to heavy schist loam | 1·8 | Furrow .. | 4 | 1½ cusecs for 24 hours | 78·64 | 17·07 tons .. | 4·6 |
| 3. Epicure potatoes .. | Light sandy loam .. | 0·329 | Furrow .. | 5 | ½ cusec for 8 hours | 60·0 | 6·5 tons .. | 9·2 |
| 4. Up to Date potatoes | Light sandy loam .. | .. | Furrow .. | 5 | ½ cusec for 8 hours | 60·0 | 8·75 tons .. | 6·85 |
| 5. Millet .. .. | Medium schist loam .. | 2·5 | Flooding from contour race | 2 | 1 cusec for 60 hours | 47·52 | Not available .. | .. |
| 6. Mangels .. .. | Heavy schist loam .. | 2·74 | Furrow .. | 4 | ⅓ cusec for 36 hours | 17·34 | 50·5 tons .. | 0·34 |
| 7. Lucerne hay .. | Light shingly soil .. | 3·0 | Flooding from contour race | 6 | 2 cusecs for 24 hours | 95·0 | 18 tons hay .. | 5·2 |
| 8. Lucerne hay .. | Medium schist loam .. | 20·0 | Border dyke .. | 6 | 4 cusecs for 24 hours | 28·51 | 5 tons silage and 3·3 tons hay | 5·2 |
| 9. Lucerne hay .. | Light and shingly .. | 10·0 | Border dyke .. | 6 | 5 cusecs for 24 hours | 71·28 | 5 tons silage and 3·2 tons hay | 5·2 |
| 10. Oats .. .. | Medium to light shingly loam | 4·75 | Flooding from contour race | 3 | 1 cusec for 8 hours (once), 2 cusecs for 24 hours (twice) | 21·6 | 1·25 tons chaff .. | 17·2 |
| 11. Wheat .. .. | Medium to heavy schist loam | 11·0 | Flooding from contour races | 1 | 2 cusecs for 72 hours | 12·9 | *40 bushels .. | 0·32 (per bushel). |

* Estimated yield was 40 bushels per acre. The crop was sown on 13th August, 1935, and was a mixture of Dreadnought, Hunters, Pearl, and Tuscan, and in the uneven ripening a fair proportion of the grain was shaken Six weeks of steady frosts after sowing delayed germination and caused rotting of over 50 per cent. of the seed, thus producing rather a thin crop.

*Potatoes.*—Although the four potato crops are not strictly comparable, still they serve to demonstrate the variations that occur under irrigation. Crops Nos. 3 and 4 required an extra irrigation, due to the light soil type with a lower moisture-holding capacity. In the "Total water used" column crop No. 2, although on heavy land, has had the most water, but has made up for that fact by producing the heaviest

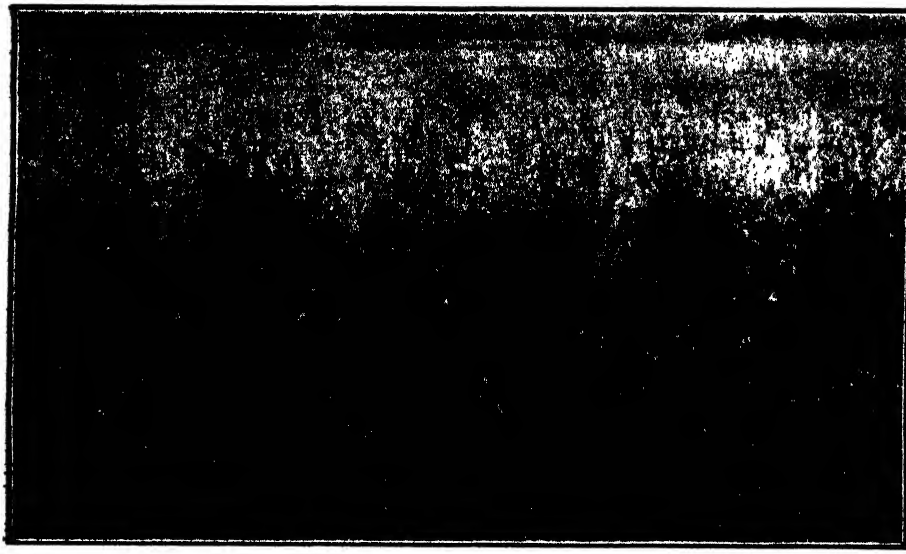

FIG. 2. THE MIXED WHEAT CROP WITH ESTIMATED YIELD OF 40 BUSHELS ON THE DUNSTAN FLAT.

FIG. 3. THE OAT CROP.

Note the good growth of red clover which was broadcast after the oats were sown.

yield, while in the "Duty of water per ton" column the figures appear reasonable when the soil types and yields are taken into consideration.

*Lucerne Hay.*—In crops Nos. 8 and 9 the first cut from these areas was made into silage, giving approximately 150 tons, the remaining three cuts were made into hay, and produced 96 tons. The "Total water used" gives a good indication of the soil type and its water-holding capacity for the three crops. The "Duty of water" figures for hay are not comparable, due to the production of silage.

*Millet.*—To the writer's knowledge this is the first season that millet has been grown in Central Otago, when four crops were grown. This season has demonstrated that millet can be successfully grown, and has a place in irrigation farming.

*Oats.*—Two irrigations of 2 cusecs were required during the growing-season, due to the light soil type. The irrigation of 1 cusec for eight hours was accidentally given when the water-race broke away, and only part of the area received this water.

*Wheat,* being on a better soil type than the oats, required only one irrigation, and a quantity of, say, 4 to 6 acre/inches of water may have been sufficient, but as there had not been enough rain to either consolidate the ground or cake the surface the soil was comparatively loose and free, and 4 in. to 6 in. of water could not have been spread over the paddock. It required 2 cusecs running for three days to cover the field.

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(1) WIDTSOE: Principles of Irrigation Practice.
(2) CALDER: Survey of Production of Irrigated Farms on Galloway Flat. *N.Z. Journal of Agriculture*, January, 1936.
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# SMALL-FARM SETTLEMENT ON RECLAIMED TIDAL FLATS, WHANGAREI HARBOUR.

R. P. HILL, Fields Instructor, Auckland.

ON the shores of Whangarei Harbour there is an area of land known as Pohe Island reclamation. Some ten years ago the Whangarei Harbour Board erected stop-banks and dug some main drains(1). Three years later the Department of Agriculture carried out experiments in the grassing of a portion of this land, some 16 acres being made available for this purpose. More open drains were dug, and the land was also underdrained. In the underdraining narrow drains were scooped out with a draining-spade about 2 ft. 6 in. deep at intervals of 2 chains apart. These drains all led into the main drains, and reached right back into the area to be drained, and were later filled in with about 1 ft. of manuka, and finally covered with earth. By this means half the area was underdrained and half was not. In December, 1928, the land was ploughed and fallowed until March, 1929, when it was cultivated and laid down to pasture. The establishment of pastures was much more rapid on the underdrained portion, although grasses and clovers eventually established

(1) C. J. HAMBLYN: "Pasture Establishment on Reclaimed Tidal Flats. See this Journal, August, 1932.

on the undrained area and the general establishment was so encouraging that it was realized that this was land that could soon be expected to carry dairy herds.

The total area of Pohe Island is approximately 100 acres, the soil is not uniform, portions of it being a stiff mud clay, and the balance a mixture of sand and clay overlying beds of pipi shells, with small areas of a silty nature—with the exception of this latter type, none of these soils crack much when drained. The experimental grassing having been so encouraging, it was decided to proceed further with the work, using unemployed labour.

In December, 1932, under the Small Farms Board Scheme, Pohe Island reclamation was subdivided into four sections and settled with unemployed families by the Department of Agriculture. Cottages were erected for each settler, and further areas were ploughed and disked and grass-seed sown in March, 1933.

At present the settlers are paying their way, this including paying rent on the land and interest on the capital expended on the holding. It must be remembered that before settlers were eligible to occupy these holdings they had to show that they had no assets.

The settlers, once in occupation, ploughed and sowed down to pasture further areas of their sections, using the same seed-mixture as that used by the Department of Agriculture, until by now very little further grassing remains to be done. The land did not dry out uniformly, and consequently this meant that further small drains had to be laid by the settlers themselves before ploughing could be undertaken. On a small area which, when the time was ready for ploughing this year, was still too wet to plough, the following treatment was adopted : Hay was fed over the area, and the tramping of the hoofs of the cattle broke the surface of the soil ; the settler later scattered more rye-grass and clover seed, and the whole is now showing an excellent strike of pasture. Splendid vegetable-gardens have been established and fruit-trees planted, which are now coming into bearing, and each man has also been kept busily employed erecting further subdivision fences, grubbing rushes where necessary, building bridges and culverts, and top-dressing and harrowing, until at the present time beyond planting shelter, there is very little further development work to be done.

This area is somewhat exposed to the cold winds. Already quite a quantity of pampas-grass has been planted and has made splendid growth. Rows of pampas along subdivision fences would not be costly : young seedlings can be obtained close at hand and a very inexpensive protection fence could be provided by using 3 in. barbed wire. Two or three of these wires strained tightly with one post to the chain and a few stakes between make an absolutely effective cattle fence, even holding back yearlings.

Flax also quickly makes excellent shelter on this class of land.

The land is now carrying good pastures, in which perennial rye-grass, strawberry clover, and white clover are dominant, with red clover, crested dogstail, paspalum, and cocksfoot sub-dominant. Throughout the summer months these pastures " threw " an enormous amount of feed, and the settlers have saved ample quantities of hay for the winter : one settler actually sold hay. It has also been found possible to close up fields this winter for early-calving cows. The stock are all looking well, and the fact that they are being carried at the rate of nearly a

FIG. 1 MIXED PASTURE, PERENNIAL RYE-GRASS, WHITE CLOVER, AND STRAWBERRY CLOVER, FOUR YEARS OLD.

FIG. 2. STRAWBERRY CLOVER COVERING BARE GROUND.

This clover has spread rapidly from the grassed areas to undeveloped portions of reclaimed tidal flats.

beast to the acre of actual pasture speaks well for the land and the management. Last season the butterfat-production varied from 140 lb. to 180 lb. per acre, and there is no reason to doubt that in a short time this will be increased to 200 lb. and over an acre.

The growth of clover has been phenomenal, more especially on the mud-clay soils, where red clover and white clover have been particularly strong, and trouble with bloat has been experienced. The most satisfactory fertilizer has been superphosphate or superphosphate and lime, and to reduce the bloat a settler has been adding small quantities of sulphate of ammonia with the idea of depressing the clover. A better remedy possibly would be the more frequent use of the mower, closing up either for hay or silage, or to mow the clover and allow it to wilt before feeding to cows.

A very satisfactory feature of the establishment of pastures is the growth of strawberry clover, more especially on the sandy and silty soils: these soils are liable to dry up badly in the summer heat, and the strawberry clover, having a deep rooting system, makes strong growth all through these months when the white clover tends to dry out.

These lands grow excellent crops of mangels and turnips, and with the prolific summer growth of pasture, enabling plenty of hay and silage to be saved, the settlers are more inclined to rely on all-grass farming. On small areas and with limited capital the providing of sufficient horse-power and the necessary implements for cropping is not an easy matter. Considering the fertility of the land, however, probably they would be wise to grow a small area of maize each year for seed purposes—maize, to carry their pigs with some grass over the periods when there is no milk, is very valuable, as it enables some pigs to be kept through the winter ready to start fattening immediately the milk-supplies are available, which is preferable to buying-in pigs for this purpose when all pigs are dear to buy. Maize would also reduce their poultry bill considerably.

There are many more tidal areas which could be reclaimed and settled in a similar manner. It must be remembered, however, that reclamation is not a rapid process: main drains and stop-banks must be erected many years before it is attempted to grow grass, and, to remove the salt quickly, underdraining is essential.

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In the Kirikopuni district areas of reed sweet grass, glyceria (*Poa aquatica*), have at some time been established in wet, swampy places and along creek-beds, which dry out somewhat in the summer. During an inspection of these areas the highly palatable nature of the feed produced was very noticeable. The surrounding pasture, which consists of paspalum and white clover, had been neglected by the cattle, become rank, and was of a dark colour. The *Glyceria aquatica* areas were being continually grazed, and their paler green colour could be seen from the surrounding hills, thus outlining the creek-beds winding along the flats.

—*Fields Division.*

# STRANGLES.

G. K. L. KNOTT, Veterinarian, Live-stock Division.

IN view of the fact that spring is approaching, and with it the time for shows, sales, &c., it is most probable that outbreaks of strangles will occur in various parts of the country. The congregating together of horses, especially young stock, from diverse localities always facilitates the spread of the disease.

Strangles is an acute contagious disease of horses (and of all solipeds) characterized by a catarrhal inflammation of the mucus membranes of the nasal cavities and throat, and by abscess formation in certain lymph-glands, usually the submaxillaries (situated at the angle of the jaw). An atypical form of the disease also occurs commonly known as " bastard " strangles.

The disease has been well-known and recognized for many generations in most countries where horse-breeding has been engaged in. As far back as the beginning of the last century an investigator named Viborg proved that nasal discharges from affected animals are infectious to healthy animals by inoculation, and towards the end of the century Schütz established the importance of the *Streptococcus equi* organism in an affected animal.

The disease occurs in all parts of the world, excepting perhaps the Argentine. It is of interest, and perhaps significance, that the condition known as " roaring " is also supposed to be unknown in the Argentine. The incidence is usually greater in establishments where breeding is carried on, as in these circumstances there is a larger proportion of young stock.

The majority of cases occur in young animals, the most susceptible age being from two months to five years old. The smaller incidence of it in older horses is due either to an immunity gained from an attack of the disease in youth or to a greater natural resistance acquired with age.

## CIRCUMSTANCES OF INFECTION.

There are many circumstances which may predispose towards infection, such as fatigue due to transport or long journeys, poor bodily condition or poor feed, hard work whilst immature, bad weather (the disease is more prevalent in autumn, winter, and spring), overcrowding in stables, bringing young horses bred in the country into cities where the different atmospheric conditions may upset the animal. Many other conditions may be added to these, but, in short, any circumstances conducive to a lowering of vitality render the animal more susceptible.

The organism, previously mentioned, which is the usually accepted cause of the disease is *Streptococcus equi*. Some authorities are of the opinion that there is another factor involved, probably an ultra-visible virus, their reason being that this organism is also found in other conditions not associated with strangles. The *Streptococcus equi*, however, is invariably present in affected animals.

## CONTAMINATED FOOD.

The most common method of infection is by ingestion of contaminated food or water. As there is usually a copious nasal discharge,

it is obvious that this contamination is easily brought about. It is also apparent how the congregating together of horses of all ages facilitates its spread—in fact, in some countries the condition is commonly known as "dealers' stables disease," &c. Communal horse-troughs are often a fertile source of infection. Flies or wind may play a part. Stables, grooming-tools, feeding-utensils, nose-bags, &c., may remain infected in spite of so-called disinfection. This latter must be very thorough to be really effective.

The pus from discharging abscesses is also infective, and the disease may be transmitted in the semen during service. Foals may infect the mammary glands of their mothers whilst suckling, giving rise to a form of mastitis, or a mare with an infected udder may transmit it to her foal.

The period of incubation—that is, the time elapsing between infection and the appearance of the first symptoms—is from four to eight days.

### The Symptoms.

The symptoms may be divided into two types—(*a*) Regular, which is fortunately the commonest type, and (*b*) irregular.

Firstly, dealing with the regular type: Typical attacks commence with dullness, lack of appetite, and some fever, and the temperature rising to between 103° and 105°. The mucus membranes of the eyes and nose become inflamed, and a watery nasal discharge soon occurs. This becomes profuse, thick, and creamy, and there is often a similar discharge from the eyes.

Two or three days after the appearance of the first symptoms the submaxillary glands become hot and painful and begin to swell. They are at first tense and fairly hard, but after a few days have elapsed a soft, fluctuating point is usually discerned at the peak of the swelling, and rupture of the abscess at this point usually results. Some coughing is usually present, and during the process quite large amounts of phlegm and mucus are blown out.

Sometimes the parotid glands and not the submaxillaries become affected. The swelling in this case will be situated over the side of the throat, often nearly half-way up to the base of the ear. When this occurs the animal is subjected to greater distress and discomfort. The head will be held stiffly with the nose poked out in an effort to relieve the distress, as the swelling will in addition be bulging into the pharynx. Breathing and swallowing will be extremely painful, difficult, and often impossible. The laboured breathing greatly exhausts the patient, and sometimes it is necessary to perform an operation, whereby the windpipe is opened, in order to relieve the distress.

### Strain on the Heart.

In these severe cases there is a great strain on the general system and heart, and the mucus membranes assume a bluish tinge. Another danger when the abscess forms in this site is that it will burst inwards and perhaps be inhaled into the lungs, when a very fatal form of pneumonia will be set up. However, great relief results when the abscess is lanced at the correct stage of development or ruptures externally of its own accord, no matter whether

it be in the submaxillary or parotid glands. From this point, providing there are no complications, there is a gradual return, through convalescence, to normal health. It is very essential that the animal should have a good spell even after all symptoms have subsided, as the internal organs, such as the heart, will take a considerable time to recuperate their normal health and strength.

Many different complications may occur during or as a sequel to an attack of strangles—chief amongst them are pneumonia and abscess formation in an internal organ. The tendons or tendon-sheathes may become affected, resulting in chronic contracted tendons. The joints may become the seat of abscess formation, causing lameness and irreparable damage. The udder in lactating mares may develop mammitis, due to the spread of the organism. The air sinuses of the head may become the site of chronic inflammation, giving rise to a persistent nasal "gleet" or discharge. Those "sinuses" are air spaces in the head formed by certain porous bones. Another possible complication is a disease known as *Purpura haemorrhagica*. It is thought that an attack of strangles predisposes to whistling and roaring, stringhalt, and shivering, and to the common osteo-arthritic diseases of the joints and bones.

### Irregular Types of Disease.

The symptoms in the irregular type may be very diverse, depending on the organs involved. There is invariably present the inflammation of the nasal mucus membrane, but the submaxillary and parotid glands may remain normal or other glands become the seat of trouble, or the mesenteric glands, situated in the belly, giving rise to colic and fatal peritonitis when they rupture. An abcess in the chest may affect the lungs or heart.

The progress in the irregular type is usually less favourable. In the regular type it is quite hopeful, providing the animal is given reasonable treatment and good nursing. The most essential part of treatment is good nursing and hygienic surroundings.

The affected cases should be isolated, and care should be taken that the disease is not spread to healthy animals by grooming or feeding utensils, or by the attendant himself.

The patient should be well rugged up if the weather is not hot, but should be given plenty of fresh air. Lack of fresh air greatly increases the risk of complications. Clean drinking-water should be available, and should be changed often as it soon becomes fouled by the nasal discharge. From 2 oz. to 3 oz. of Epsom salts may be given daily in the drinking-water. The animal is better not tied up, and should be allowed free use of his head. The nose and eyes should be kept clean by sponging out frequently. This prevents the discharge from "scalding" the skin. The swelling in the glands may be treated with fomentations, liniments, or a mild blister, in order to hasten the ripening of the abscess. When ripe—that is, when a definite soft doughy spot, which tends to shed its hair, can be felt—it should be lanced with a knife previously sterilized by boiling. There is a considerable danger of damaging a nerve or blood-vessel if this operation is performed too soon. After opening, the cavity should be syringed out daily with a disinfectant and the skin surrounding the wound kept clean. The cavity should heal from the bottom, and the lips of the wound should be kept open whilst this proceeds by inserting a clean plug of cotton-wool.

Avoid drenching the animal, as much damage may be done by it, and, in any case, very little good would result.

If the breathing becomes very thick relief may be obtained by inhalations of steam from hot water, to which has been added a few drops of turpentine, oil of eucalyptus, or Friars balsam

## Importance of Feeding.

The feeding of the patient is of importance. The bowels may be regulated with bran mashes. If the animal can swallow easily green foods may be given, or a little steamed hay, crushed oats, or, occasionally, sliced carrots. In any case, the food should be of a soft non-irritating nature.

If swallowing is difficult sloppy foods should be given—for instance, thin oatmeal or linseed gruel, hay tea, or milk and raw eggs. These things are best given in a bucket on the ground or placed in some low position as the chance of it "going down the wrong way"—down the windpipe—is not as great when given thus. Any food not eaten by the animal should be removed and not left in front of him to become fouled.

In good warm weather the animal may be better out in the open providing some shade is available and that flies and dust can be avoided as far as possible.

Subsequent to recovery a long rest is essential, and when work is resumed it must be done so gradually, otherwise serious and irreparable damage may be done to the heart or wind.

In severe and complicated cases professional advice should be sought, as special lines of treatment may be indicated to meet the individual requirements of the case.

Regarding prevention, predisposing causes already mentioned should be avoided as far as possible. When an outbreak occurs, strictly isolate the affected cases. At one time strangles was regarded as an inevitable complication in the rearing of young horses, and it was the practice to try to spread it to all the susceptible horses in the stable when an outbreak occurred. The object was to get the trouble over as soon as possible, as one attack renders the animal immune to subsequent infection. The practice is of doubtful value, and not to be recommended, as, apart from other factors, some authorities are of the opinion that at least 15 per cent. of recovered animals are affected in the wind.

## Serums and Vaccines.

There are certain serums and vaccines which are reputed to be capable of conferring, at any rate, a temporary immunity to the disease. These may be useful in protecting horses which are liable to be exposed to infection when coming into contact with horses from other establishments or districts, and they may also be of value as a curative agent in treatment; but, so far, it can definitely be taken that there is no recognized specific inoculation, either as a preventative or curative, for this disease, and until the discovery of the causative agent is finally determined inoculations will of necessity be of a "hit or miss" nature.

Owners would be well advised to direct their efforts towards nursing, management, &c., rather than to the use of nostrums of questionable value.

# CONTROL OF BROWN-HEART IN SWEDES.

J. W. Woodcock, Crop Experimentalist, and D. M. Merry, Assistant Crop Experimentalist.

Following on results of field trials conducted in the 1935–36 season* further experiments have been carried out by the Fields Division during the past season to ascertain—

(a) The minimum quantity of borax necessary to control brown-heart:

(b) The effect of borax on seed-germination at various rates of application:

(c) The effect of the addition of lime to borated fertilizer mixtures on germination and control of brown-heart:

(d) The effect of applying borax broadcast before and after sowing.

The thirty-five trials laid down on swede crops were distributed throughout districts where brown-heart has been prevalent in the past.

## Methods used in Trials.

The Beaven half-drill strip method was adopted where comparisons of the various treatments with and without borax were included. This method, in which the manure-box is divided, allows one-half of the fertilizer to be sown with borax and the other half without. Contrary to expectations the admixture of even small quantities of borax with fertilizer affected the rate at which the fertilizer was delivered, thus making the application of a stipulated quantity exceedingly difficult. The fertilizers used were of various types, including proprietary manures, farmers' own mixtures, and fertilizer plus lime mixtures. The method of sowing included 7 in. drills, 14 in. drills, and the 26 in. ridges usual in Southland. In several trials in which the ridger was used part of the fertilizer and borax was sown from the front box of the drill and part from the rear box, thus securing placement of part of the mixture below the seed.

## Application of Borax.

Borax was mixed and drilled along with the fertilizer and seed in the majority of trials, and in these the amounts of borax applied were 3 lb., 6 lb., 9 lb., and 12 lb. per acre. In the remainder the material was broadcast at 8 lb. or 10 lb. per acre either prior to or immediately following drilling, while in a few of these broadcast applications were made at thinning, and also when the crop was half grown, in addition to the dressings given at seeding.

## Effects on Germination or "Strike."

Observations were made shortly after the sowing of the trials to determine the extent of any detrimental effect on seedling development. Previous experience* had indicated that under certain conditions borax sown along with the fertilizer and seed could exert a certain amount of injury. The appearance of creamy-coloured cotyledons and a retardation of growth at the cotyledon stage are the general symptoms of this toxic effect. Under some circumstances, probably regulated by

* Woodcock, J. W.: *N.Z. Journal of Agriculture*, Vol. 53, No. 2; August, 1936.

soil-moisture conditions, these symptoms may disappear at a later stage, but under conditions more unfavourable to growth many of the seedlings perish and cause a patchy "strike." Where the latter conditions were easily apparent in the experiments this fact was noted, although sometimes actual plant counts were taken.

No germination injury or retardation of growth was apparent in any of the trials in which borax was *broadcast*, although in one, where it was applied at the thinning stage, further development was retarded.

When *drilled* along with fertilizer and seed, borax sometimes caused a reduction in the field germination. With the heavier rates of application—9 lb. and 12 lb. per acre—poor strikes were frequent and seedling development was retarded, this applying to fertilizer mixtures with and without the addition of lime.

The following table summarizes the general effect of borax in the trials in which the material was drilled with fertilizer and seed :—

*Table 1.—Effect of Borax sown with Fertilizer on "Strike" of Swedes.*

| Effect on Strike of Different Quantities of Borax. | Number of Trials. |
|---|---|
| No detrimental effect from borax treatment .. .. .. | 10* |
| 3 lb., 6 lb., and 9 lb. had no effect ; 12 lb. was detrimental .. .. | 1 |
| 3 lb. and 6 lb. borax had no effect ; 9 lb. and 12 lb. detrimental .. | 2 |
| 3 lb. had no effect ; 6 lb., 9 lb., and 12 lb. detrimental .. .. | 2 |
| 3 lb., 6 lb., 9 lb., and 12 lb. borax all detrimental .. .. .. | 13† |

* Includes six trials in which 8 lb. or 10 lb. borax were the only quantities used. † Includes two trials in which 9 lb. or 10 lb. borax were the only quantities used.

In several experiments not included in the above table germination on both treated and untreated areas was poor, and it was not possible on these to carry out counts or estimates with any degree of accuracy. Although various methods of drilling have not been investigated in any one trial a general review of the experiments indicates that more severe injury took place in the crops drilled 14 in. apart than those spaced in 7 in. rows or 26 in. rows (where part of the borated fertilizer had been sown below the seed).

## Effect of Borax on Control of Brown-heart.

Inspections of the crops were made just prior to feeding off, and a number of roots (generally 50 or 100) on each treatment were taken at random and cut for examination. In seven trials no brown-heart was detected in any of the treatments.

Where borax was applied *broadcast* before sowing at 10 lb. per acre, control of brown-heart was satisfactory in five trials, while in two experiments the disease (slight in both cases) was not controlled by the treatment.

Table 2 summarizes the position in respect of brown-heart control where borax in various quantities was *drilled* with seed and fertilizer.

*Table 2.—Summary of Results from Borax sown with Fertilizer on Incidence of Brown-heart in Swedes.*

| Degree of Control from Borax. | Number of Trials. |
|---|---|
| Trials free from brown-heart .. .. .. .. .. | 4 |
| Complete control or high degree of control from 3 lb., 6 lb., 9 lb., and 12 lb. | 7 |
| Complete control or high degree of control from 6 lb., 9 lb., and 12 lb. only | 3 |
| Complete control or high degree of control from 8 lb., 9 lb., and 12 lb. only | 4* |
| Complete control or high degree of control from 12 lb. only .. | 3 |
| Moderate control from 3 lb., 6 lb., 9 lb., and 12 lb. borax .. .. | 3 |
| Brown-heart (all slight infection) not controlled by borax .. .. | 3† |

* Includes three trials in which 8 lb. borax was the only quantity used. † Includes two trials in which 8 lb. borax was the only quantity used.

## Comments on Table 2.

Out of twenty-three trials in which brown-heart was present, borax gave a complete control or a high degree of control (reduced the infection by 70 per cent. or more) in seventeen. In the three trials where borax had no effect and in one trial where control of brown-heart was only moderate, the infection was only slight, the number of infected bulbs being less than 5 per cent. on the untreated plots in each case. This leaves two experiments in which fairly severe infection was only slightly reduced by borax.

Owing to early retardation of growth as a result of applying borax with manure and seed the swedes on treated areas were often small although free from brown-heart. However, in some trials it was noted that the "intensity" of brown-heart infection on individual roots was more severe on treated than on untreated drills. In one trial the infection was more severe on the drier knolls, while in another one located on two distinct soil types the incidence of brown-heart was several times greater on a peaty soil than on a friable loam; the addition of borax was effective on both soil types however.

## Summary and Recommendations.

From the results of thirty-five trials carried out to investigate the effect of borax applied by different methods on control of brown-heart, it would appear that the method of mixing borax with fertilizer and sowing in intimate contact with swede-seed is open to some risk owing to a possible adverse effect on the "strike." This occurred in some instances with quantities of borax as low as 3 lb. per acre. The application of borax at 10 lb. per acre broadcast before sowing had no such adverse effect.

Satisfactory control of brown-heart was obtained from borax applications except in six experiments, in two of which neither drilling nor broadcasting had any effect. The incidence of brown-heart in four of these unsatisfactory trials was only slight. Of the trials in which borax was drilled, the application of 3 lb. or more per acre gave a high degree of control in seven, in three the minimum

effective quantity was 6 lb., while in seven at least 9 lb. to 12 lb. appeared necessary. In one of the latter, whereas applications at 3 lb. and 6 lb. respectively were only slightly effective, 10 lb. of borax broadcast prior to sowing appeared as satisfactory as 9 lb. and 12 lb. applied in close proximity to the seed. Broadcasting the material at about the thinning-stage appeared to be equally efficient as broadcasting prior to seeding, although the latter should be preferable. When applied to crops about half-way through the growing-period, borax was generally less effective. The addition of lime to borated mixtures showed no advantage or detriment either as regards effect on "strike" or control of brown-heart.

In view of the possibility of injury to the establishment when borax is applied with the seed, wherever possible the material should be applied at from 10 lb. to 20 lb. per acre *broadcast* before sowing or shortly afterwards. To facilitate distribution it should be applied either along with sawdust or soil. If top-dressing is impracticable the drilling of 3 lb. to 6 lb. of borax per acre is less likely to cause severe injury than with the heavier applications, and from the evidence obtained this quantity is likely to have a fair measure of control. By sowing the crop in 7 in. drills, or by putting half the borated fertilizer below and half with the seed, as is possible with the ridger, the liability to injury is likely to be further reduced.

ACKNOWLEDGMENTS.

The field work in connection with the trials was carried out by Instructors of the Fields Division under the direction of Fields Superintendents at Hamilton, Palmerston North, Christchurch, and Dunedin respectively. Thanks are extended to the farmers who co-operated in carrying out the experiments.

## INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published recently in the *New Zealand Patent Office Journal*, include the following of agricultural interest:—

No. 78127: Mower-driving means; C. E. Bailey. No. 78144: Turnip-cutting tool; W. de M. Lindop. No. 78150: Manure-distributor; G. R. Petch. No. 78152: Teat-cup; S. A. C. Gallichan and A. C. Kerr. No. 78156: Plant-growing method; W. Malone. No. 78169: Sheep overall; Smith, Copeland, and Co., Pty. No. 78192: Shearing-machine comb-trimmer; J. B. Anderson. No. 78218: Grassland cultivator; H. T. Gillies. No. 78229: Cultivator; A. V. Pettman. No. 78248: Teat-cup; C. F. Laxton. No. 78270: Water-pump; G. S. Foote. No. 78278: Milk-delivering means; H. W. Lee. No. 78289: Fencing-post; A. Howard. No. 78292: Fencing-dropper; W. Stubbs.

**Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.**

Silver poplar (*Populus nivea*) has been declared a noxious weed within the Borough of Matamata.

*Phalaris arundinacea* has obtained a good footing in a swamp at Kopuka, and rivals *Poa aquatica* in its aggressiveness in the swamp, yet providing more palatable and earlier feed. It is ousting blackberry and rushes. It appears to be more aggressive than *Poa aquatica* on the less wet parts of the swamp and it is expected that it will prove a valuable addition to the swamp grasses in the lower Waikato Basin.—*Fields Division*.

# WINTER GRASS.

E. R. MARRYATT, Ruakura Farm of Instruction, Hamilton.

WITHOUT nitrogen grass will not grow. When the soil is warm, growing clover supplies nitrogen to grass, and at that stage artificial nitrogen is not economical. In the winter, however, when the soil is cold, and normally clover is growing very feebly. artificial nitrogen may be profitable when correctly used.

## ARTIFICIAL NITROGEN, PLUS SUPER, FOR WINTER GRASS.

The correct use of artificial nitrogenous fertilizers, particularly sulphate of ammonia, demands prior and adequate phosphating and liming of the pasture; at least 3 cwt. of each to the acre every year is necessary. Artificial nitrogenous fertilizers may be applied between April and August, but for winter grass they should be applied in April or early May, and, particularly, only when the grass is still growing and when it has some little growth—say, 2 in. Keeping stock off the treated pasture until the growth has reached about 9 in. is equally as important. The top of the spelled pasture should then be grazed off, leaving about 3 in. ungrazed. Do not graze bare. Then spell the pasture again.

## USE OF SUPERPHOSPHATE ALONE.

When sufficient clover in a pasture has been growing vigorously for a month or two prior to the winter, it will continue to supply some nitrogen to the grass even when the soil becomes fairly cold. If the clover has been refreshed by a March or April top-dressing of super and thereafter spelled from grazing, it will provide the most nitrogen possible. It will continue to supply some nitrogen to the grass even when the soil becomes very cold.

In order to allow a growth of grass for the winter, hay and other supplements must be fed out before they are actually required. Feeding out normally begins when pastures have been grazed bare; but to grow winter grass feeding out must begin some weeks before it is actually necessary. Only in this way can fields be closed up while the grass is still growing.

## BOTH METHODS AT RUAKURA.

This year both methods of providing winter grass have been tried at Ruakura.

Transport difficulties unfortunately delayed the application of nitrogen. The sulphate of ammonia was not applied until the 7th June. By this time the pastures had been spelled since the 19th April—forty-nine days of mild "growthy" weather. The growth averaged 6 in. Still more unfortunately, hard frosts followed. Frosts of 6·4 degrees, 16·7 degrees, and 7·4 degrees were recorded on the first three nights. Little improvement due to the nitrogen can therefore be expected until after the first grazing-off; no differences have yet been seen. On the 14th July the growth averaged 8 in.

On the other hand, the superphosphate treatment ran to schedule, and the weather was favourable. The superphosphate fields were also closed to stock on the 19th April, being top-dressed with superphosphate and lime on the same day. The growth on the 14th July averaged 8 in.

Both sulphate of ammonia and superphosphate treated pastures are to be grazed immediately. They are to be grazed down as evenly as possible to about 3 in. or 4 in. The aim is to let the light in to the clovers, and also to prevent the undergrowth from decomposing and becoming not only unpalatable, but also quite useless.

FIG. 1. SIDE VIEW OF TURF REPRESENTING THE PASTURE ON 13TH JULY, 1937. Pasture consists mainly of fog, rye-grass, cocksfoot, and white clover.

[*Photo by H. Drake.*

## Free Nitrogen compared with Purchased Nitrogen.

The most obvious and important difference is one of cost. This will be the difference between the total cost of applying the artificial nitrogen and the value of the return of growth over and above that returned by superphosphate alone. Management and the season together will decide whether the cost will be returned. The weather is very important—for example, this autumn and early winter was very mild and favourable to natural nitrogen; c.overs grew well and supplied plenty of nitrogen to the grass. Grazing management is also very important, and the Ruakura grazing trials have been ar anged to teach us something about it.

Other differences between artificial and natural nitrogen-grown grass are comparatively unimportant, but they are interesting. All artificial nitrogen is not fool-proof; superphosphate is. On the other hand, artificial nitrogen-grown grass does not "winter-burn" as does natural nitrogen-grown grass. Again, response from superphosphate is spread out over a longer period than is that from applied nitrogen. Against this, however, in natural nitrogen-grown grass shut up for a long time, partial decomposing of the undergrowth may occur; but suitable grazing management is expected to overcome this difficulty.

FIG. 2. TOP VIEW OF TURF IN FIG. 1.

Pasture shut up on 19th April; photo taken on 13th July, after eighty-five days' spelling. Commencing on the 19th July, forty-six P.A. cows and forty-six P.A. calves of mixed ages and sizes grazed the winter-spelled area of 7½ acres for eight full days. There was then from 3 in. to 4 in. of herbage ungrazed.

[*Photo by H. Drake.*

## Conclusion.

Without nitrogen grass will not grow. Clovers and live-stock supply enough nitrogen to grass on most New Zealand pastures, except in the winter. Winter grass may be grown either by buying artificial nitrogen and putting it on the pastures, or by giving the clovers every opportunity to carry on their good work. Both methods are good. The season itself will decide whether purchased nitrogen pays.

There is a big interest being taken in subterranean clover in the Marlborough District. Many farmers have placed large orders for the seed. The seed sold so far is of local production, the Australian product not yet having arrived. An idea of the magnitude of some of the orders may be gleaned by one of thirty 200 lb. sacks—sufficient to sow down 1,500 acres. This seed is going on to a back-country run, where it should be very beneficial.—*Fields Division.*

# GRADING OF EXPORT BUTTER AND CHEESE.

## LEADING DAIRY FACTORY AVERAGES FOR THE YEAR 1936–37.

Butter-manufacturing companies which have obtained an average grade of 94 points or over and cheese-manufacturing companies which have obtained an average grade of 93 points or over are listed below. Of the total of 182 creameries and dual-plant factories manufacturing butter for export, thirty-four are included in the list, as compared with thirty-two for the preceding year, and of the 297 cheese-factories and dual-plant factories manufacturing cheese for export, twenty-two, as compared with twenty for the previous year, have averaged 93 points or over. Of the total factories listed, twenty-six butter and thirteen cheese are situated in the North Island and eight butter and nine cheese in the South Island.

| Company or Proprietor. | Registered No. | Brand. | Tonnage graded. | Average Grade. |
|---|---|---|---|---|
| | | **Butter-factories.** | | |
| T. and P. Milk-supply Co., Ltd. | 54 | Sweet Briar, &c. .. | 27 | 94·959 |
| Rangitikei Co-op. .. | 1360 | Rangitikei.. .. | 686 | 94·826 |
| Murchison Co-op. .. | 1888 | Airship .. .. | 262 | 94·778 |
| United Co-op. .. .. | 1296 | Whariri .. .. | 279 | 94·752 |
| Kaikoura Co-op. .. | 302 | Kai .. .. | 220 | 94·751 |
| Rodney Co-op... .. | 394 | Rodney .. .. | 438 | 94·684 |
| Collingwood Co-op. .. | 1254 | Golden Hills .. | 226 | 94·654 |
| Awahuri Co-op. .. | 664 | Red Rose .. .. | 850 | 94·635 |
| Rangiwahia Co-op. .. | 750 | Quail .. .. | 150 | 94·629 |
| Taihape Co-op. .. | 1188 | Tikapu .. .. | 535 | 94·542 |
| Eketahuna Co-op. .. | 46 | Eketahuna .. | 181 | 94·474 |
| Rata Co-op. .. .. | 938 | Rata .. .. | 1121 | 94·430 |
| Northern Wairoa Co-op | 4 | Northern Wairoa .. | 624 | 94·390 |
| Levin Co-op. .. .. | 910 | Lake .. .. | 1573 | 94·367 |
| Karamea Co-op. .. | 302 | Karamea .. .. | 224 | 94·340 |
| Ruawai Co-op. .. | 66 | Ruawai .. .. | 1681 | 94·308 |
| Golden Bay Co-op. .. | 146 | Sovereign .. .. | 721 | 94·280 |
| Cheltenham Co-op. .. | 3 | Pakeha .. .. | 2172 | 94·253 |
| Shannon Co-op. .. | 1489 | Shannon .. .. | 1232 | 94·241 |
| Maungaturoto Co-op. .. | 1407 | Otamatea .. | 1153 | 94·230 |
| Uruti Co-op. .. .. | 300 | Uruti .. .. | 257 | 94·219 |
| Rongotea Co-op. .. | 8 | Rongotea .. .. | 1012 | 94·209 |
| Lepperton Co-op. .. | 49 | Lepperton.. .. | 176 | 94·177 |
| Wangaehu Co-op. .. | 1326 | Wangaehu .. | 640 | 94·150 |
| Inter-Wanganui Co-op. .. | 6 | Inter-Wanganui .. | 187 | 94·149 |
| Municipal Milk Department, Wellington | 202 | Rahui .. .. | 128 | 94·131 |
| Piopio Co-op. .. .. | 603 | Piopio .. .. | 475 | 94·111 |
| Tolaga Bay Co-op. .. | 1007 | Tolaga Bay .. | 281 | 94·055 |
| Masterton Co-op. .. | 1307 | Masterton .. | 888 | 94·037 |
| Kuku-Manakau Co-op. .. | 905 | Ohau .. .. | 236 | 94·028 |
| Arahura Co-op. .. | 1516 | Arahura .. .. | 79 | 94·027 |
| Takaki Co-op. .. .. | 1463 | Bell .. .. | 562 | 94·023 |
| Kaikohe Co-op. .. | 40 | Kaikohe .. .. | 308 | 94·013 |
| Kaipara Co-op. .. | 794 | Popular, Filbert .. | 2506 | 94·012 |

| Company or Proprietor. | Registered No. | Brand. | Tonnage graded. | Average Grade. |
|---|---|---|---|---|
| | | **Cheese-factories.** | | |
| Kaimata Co-op. .. | 992 | The Oaks .. .. | 391 | 93·732 |
| Rai Valley Co-op. .. | 519 | Rai Valley .. | 311 | 93·691 |
| Milton Co-op. .. .. | 1030 | Milton .. .. | 105 | 93·601 |
| Omimi Co-op. .. .. | 74 | Omimi .. | 59 | 93·547 |
| Little Akaloa Co-op. .. | 32 | Little Akaloa .. | 55 | 93·468 |
| Stirling Co-op. .. | 292 | Stirling .. .. | 329 | 93·307 |
| Westmere Co-op. .. | 1621 | Westmere .. | 356 | 93·276 |
| Cardiff Co-op. .. .. | 10 | Cardiff .. .. | 662 | 93·269 |
| Stratford Co-op. .. | 219 | Huinga .. .. | 303 | 93·210 |
| Wairewa Co-op. .. | 471 | Wairewa .. .. | 144 | 93·203 |
| Mangawhata Co-op. .. | 1343 | Mangawhata .. | 362 | 93·202 |
| Parkvale Co-op. .. | 1240 | Parkvale .. .. | 306 | 93·180 |
| Royal Oak Co-op. .. | 693 | Royal Oak .. | 137 | 93·163 |
| Titiroa Co-op. .. .. | 361 | Cloverpark .. | 130 | 93·159 |
| Kahui Co-op. .. .. | 493 | Kahui .. .. | 280 | 93·115 |
| Waikaka Co-op. .. | 1067 | Waikaka .. .. | 27 | 93·104 |
| Kaponga Co-op. .. | 1696 | Rowan .. .. | 381 | 93·084 |
| Dannevirke Co-op. .. | 391 | Dannevirke .. | 188 | 93·070 |
| Cam Co-op. .. .. | 168 | Cam .. .. | 95 | 93·067 |
| Rapanui Co-op. .. | 1714 | Southern Grove .. | 121 | 93·065 |
| Pembroke Co-op. .. | 234 | Pembroke .. | 383 | 93·046 |
| Jolls, T. L., Co-op. .. | 1862 | Maori Chief .. | 468 | 93·042 |

—*Dairy Division.*

# NOTES ON RECENTLY OBSERVED EXOTIC WEEDS.

H. H. ALLAN, Plant Research Station, Palmerston North.

## 10. Mexican Marigold (*Tagetes minutus*).

THIS potentially serious weed has recently been observed by Mr. M. Hodgkins in waste places about Auckland, and has also been noted near Palmerston North. It belongs to a genus of composites containing about twenty species indigenous to the sub-tropical and tropical parts of the Americas, several of which have become naturalized in other parts of the world, though none appears to have become of moment in the United States. From the wild plants have also been developed certain favourite garden plants curiously misnamed "French" and "African" marigolds.

*T. minutus* has given trouble both in South Africa and in Australia, in the latter country being known as "stinking Roger." Bailey ("Weeds and Suspected Poisonous Plants of Queensland," 1906) says it "has become one of the worst of our cultivation weeds." In Europe it has established itself in various parts of Germany and in Switzerland, its entry into the latter country being traced to refuse from Australian wool. Lansdell ("Weeds of South Africa," 1925) says, "This weed was probably introduced into South Africa during the Anglo-Boer War, and was first reported from the Charlestown district, Natal. It is now widely distributed in the Union and Rhodesia." She speaks of the rapidity of its spread as "almost incredible," and remarks that it has

"a wonderful adaptation to various climatic conditions, and it passes through several life cycles in one season." It is now proclaimed as a noxious weed in most parts of the Union. Lansdell's recommendations

FIG. 1. MEXICAN MARIGOLD (*Tagetes minutus*).

(After K. A. Lansdell in "Weeds of South Africa." Government Printer, Pretoria.)

for control are—"All plants should be pulled up and burnt. In cultivated grounds tillage should be continued late in the season in order to prevent the development of seed from late-blooming flowers." This would appear a tremendous piece of work for South Africa, but

is a practicable proposition for New Zealand if attended to at once. Certainly the specimens I have seen testify to the plant's powers of luxuriant growth and heavy production of seed, at least in the warmer parts of the country, and it is obvious that neglect for a very few seasons would enable it to become thoroughly established.

*T. minutus* (Mexican Marigold), (Fig. 1): An erect, much-branched annual, reaching anything from 3 ft. to 9 ft. high, with smooth, tough stems. The leaves are rather "fern-like" with about three pairs of leaflets and a terminal one. The leaflets are about 2 in. to 3 in. long, narrow, lance-shaped, and strongly toothed. The flower-heads are narrow tubes, about ½ in. long, produced in great masses at the tips of the branches. There are six to twelve flowers to the head, the outer with small yellowish rays, the inner tubular. The fruits are narrow, about ¼ in. long, tapering to the base, black, but covered with appressed brownish hairs, and furnished at the tips with six whitish chaffy scales, of which one is much longer than the rest. The whole plant when bruised has a distinct "marigold" odour.

### 11. Yellow Weed (*Galinsoga parviflora*).

The few species of the genus of composites to which this belongs range from Mexico to the Argentine, the present species having its headquarters in Peru. It is now very widely spread, being found throughout the Americas, over the greater part of Europe, in Africa and eastern Asia, and in Australia. The European occurrences are considered to be derived from its early cultivation in the Paris Botanical Garden, where is was introduced in 1794 and whence it was distributed to other botanical institutions. Hegi, in his Illustrated Flora of Europe, gives a detailed account of its escapes from cultivation and its widespread establishment. In England the plant is particularly common about Kew, being first grown at the Kew Gardens in 1796. It appeared in Australia as early as 1873, and is now widely spread, though apparently not especially common in any locality.

In all countries it appears to favour good soil, and is mainly a garden or waste-place weed controllable by the usual treatment for annuals. Seed-production is considerable, and if seeds become buried at all deeply they remain dormant and viable for a number of years. The plants are rather frost-tender, but in very warm areas may be bearing flowers six weeks after germination.

The plant was first noted in New Zealand by Kirk in 1892 on a heap of ballast deposited by a ship from Buenos Ayres. It appears to have died out, as no further record of it has been made about Wellington. In 1935 I noted a number of plants on reclaimed land at Stanley Bay, near Auckland, and subsequently several gardens were found to contain it. As a weed it will have much the same place as the groundsel, where frost is not severe.

*Galinsoga parviflora* (Yellow Weed), (Fig. 2): An erect annual, varying greatly in stature according to soil conditions, when well developed of a bushy habit, 18 in. high or more. The stems are six-angled in the lower parts, usually with a three-fid arrangement of the branchlets. The leaves are in pairs, thin, ovate, and tapering to the tips, more or less bluntly toothed on the margins, about 1½ in.

to 2 in. long. The flower-heads are small, about ¼ in. across, and usually occurring in groups of about three on slender stalks. The outer floret has small white rays and the inner are tubular and yellow.

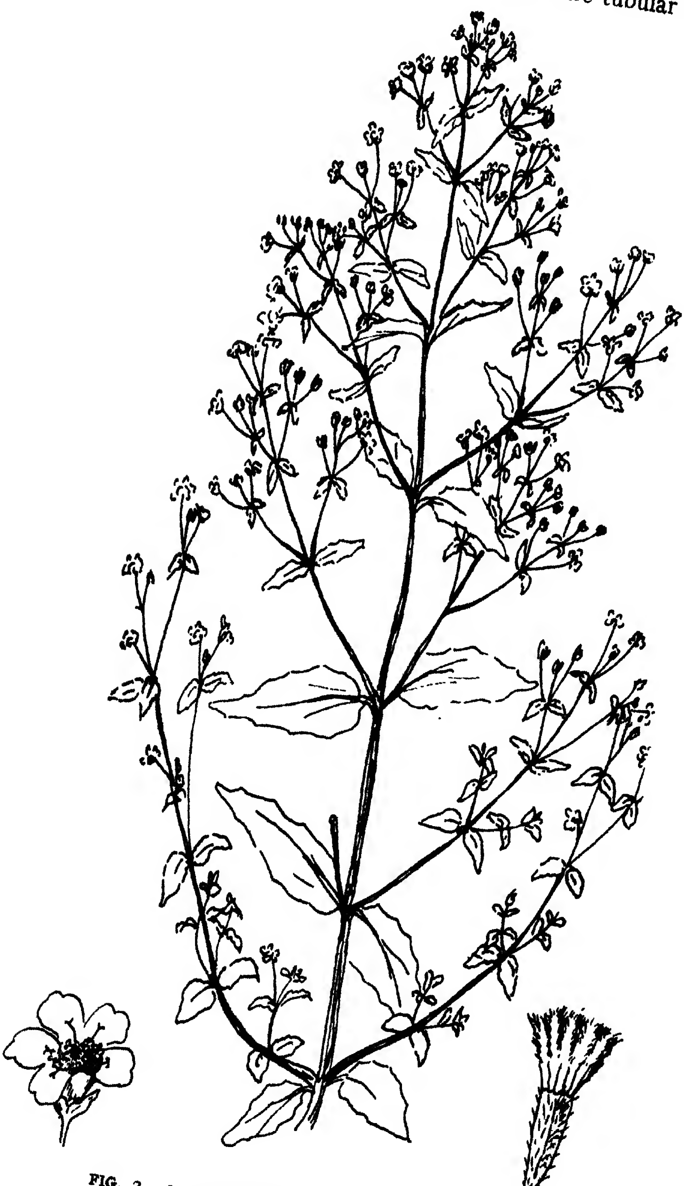


FIG. 2. YELLOW WEED (*Galinsoga parviflora*).

The fruits are small, four-sided, dark-brown, with a covering of white hairs, and surmounted by thin, flat scales with comb-like fine teeth on the margins.

# TOBACCO-MOSAIC.

## ITS APPEARANCE, CAUSE, AND CONTROL.

E. E. CHAMBERLAIN, Plant Diseases Division, Plant Research Bureau, Department of Scientific and Industrial Research.

AT some stage in the history of most of the main tobacco-growing regions of the world tobacco-mosaic has become a serious problem to the grower. That the disease is now of minor importance in many of these regions shows that it may be controlled when adequate precautions are taken.

In New Zealand it is only within the last four or five years that tobacco-mosaic has become a major problem. As yet, there has been no organized attempt to control it. Provided strict precautions are taken, however, there is no reason why the disease should not be as effectually controlled here as in other countries. In this paper, based on experimental results published elsewhere (Chamberlain, 1937*), are indicated measures necessary for its prevention.

### APPEARANCE ON THE PLANT.

The most obvious symptom of tobacco-mosaic is a mosaic pattern of light- and dark-green areas on the leaves (Fig. 1). The design of this pattern is not constant (Figs. 1 and 3), but the dark-green areas usually occur along the veins (Fig. 1). A blistered appearance of the leaves sometimes results from more rapid growth of the darker green tissue (Figs. 2 and 4). Leaf-spotting also frequently develops on infected plants (Fig. 5), this type of injury being most prevalent on Burley varieties (Fig. 6).

Plants which become infected early in the season are usually much stunted (Figs. 7 and 8), while those infected later are not so much reduced in size. In the case of a severe attack, resulting from an early infection, the leaves are narrow, puckered, thin in texture, and often spotted, and are valueless for curing purposes (Figs. 2 and 6).

When tobacco-mosaic attacks a plant late in the season symptoms show only on the new growth. Thus if a plant becomes infected during topping, mottling usually develops only in the laterals.

On seedling plants the symptoms are not so conspicuous, consisting of a few dark-green raised areas on two or three leaves (Fig. 4). Such plants are usually smaller than healthy seedlings, and, in the seedling-beds, are often hidden by the leaves of adjacent healthy plants.

*Symptoms do not develop immediately after Infection.*—The mosaic mottling of the leaves does not appear until about two to four weeks after infection has taken place. The time taken for symptoms to show depends upon the rate of growth of the plants, being less than two weeks if they are growing vigorously and greater than four weeks if they are growing slowly.

* Chamberlain, E. E. (1937): *N.Z. Jour. of Sci. and Tech.*, Vol. XIX, No. 4, September, 1937.

### Cause of Tobacco-mosaic.

Tobacco-mosaic is caused by one of a well-defined group of diseases known as plant viruses. The word "virus" is used to describe a large group of diseases some of which attack man, some animals, and other plants. A well-known virus disease of man is "infantile paralysis," and one of the best-known plant viruses is "tobacco-mosaic."

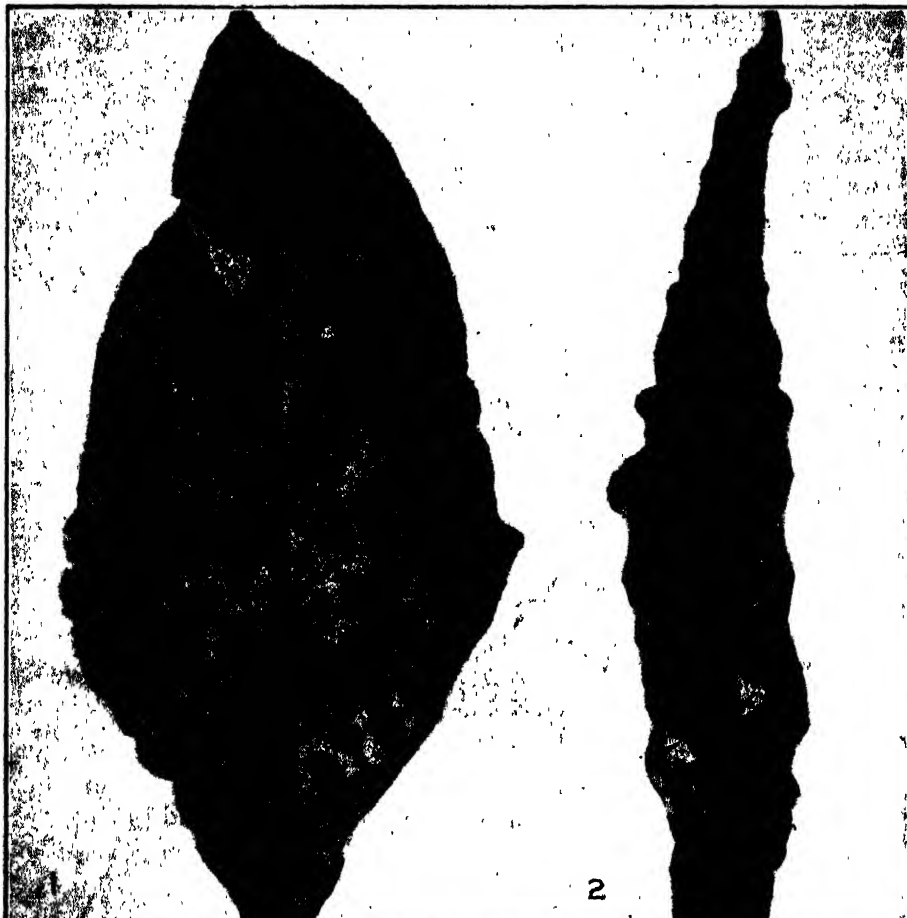



FIG. 1. MOSAIC MOTTLING OF TOBACCO-LEAF CAUSED BY TOBACCO-MOSAIC.

FIG. 2. MOSAIC-INFECTED TOBACCO-LEAF.
Showing narrowing and blister type of mosaic mottling.

*[Photos by H. Drake.*

These two diseases show general similarities: both are spread by contact and are caused by minute organisms. They are dissimilar in that a person may recover from an attack of infantile paralysis, but a tobacco-plant never recovers from an attack of tobacco-mosaic.

Plant viruses are usually spread by insects or by rubbing the juice from a diseased plant over the leaves or stem of a healthy plant. The tobacco-mosaic present in New Zealand is the same as that which occurs in other countries.

*Extent to which Tobacco-mosaic occurs in New Zealand.*—It is only five years ago that tobacco-mosaic first began to be a serious problem to growers in the Nelson District. Since then it has increased to such an extent that, to-day, it is the most important factor in the economic production of tobacco-leaf.

An inspection of crops throughout the district has shown that the amount of tobacco-mosaic has steadily increased during the past four seasons. The estimated average percentage infection in 1933 was less

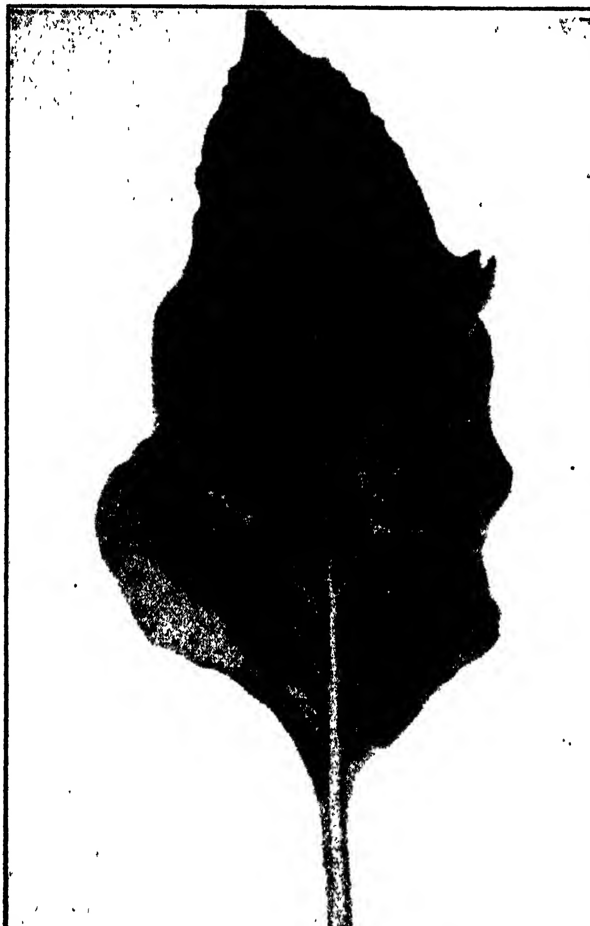


FIG. 3. TOBACCO-MOSAIC ON TOBACCO-LEAF.

Showing symptoms in which the mosaic pattern does not follow the veins.

[*Photo by H. Drake.*

than 10 per cent., while during the past season it appeared to be well over 25 per cent. The disease also occurs in the Auckland Province, but to a much lesser extent.

*Effect on Yield and Quality of Leaf.*—In other countries tobacco-mosaic causes a reduction in crop-yield, and the leaf from plants infected early in the season is often valueless on account of its small size, thinness, poor colour, and spotting. Late infection up to the topping stage causes a slight reduction in yield and a lowering in leaf-quality.

The same is true of tobacco-mosaic in New Zealand, leaf-spotting being in particular a destructive feature of the disease in this country. In one crop of Burley tobacco, examined in 1933, leaf-spotting following mosaic was so severe that over 20 per cent. of the crop was left unharvested.

Trials in experimental plots at Palmerston North have shown that infection of plants shortly after they have been set out in the field caused a reduction in yield of 44 per cent. in a Virginian variety and 78 per cent. in a Burley variety. Leaf from these plants was quite useless for curing purposes (Fig. 6). Infection later in the season caused a reduction of 24 per cent. in the Virginian and 25 per cent. in the Burley variety. The leaf was of poor quality, but some of it was of a saleable grade (Fig. 6).

FIG. 4. TOBACCO-MOSAIC ON SEEDLING TOBACCO-PLANT.
Showing blister-like dark-green areas. Healthy plant on right.
[Photo by H. Drake.

## TOBACCO-MOSAIC ALSO OCCURS ON OTHER PLANTS.

Many plants are attacked by tobacco-mosaic, the most important of these under New Zealand conditions being tomato, black nightshade, Cape gooseberry, Turkestan tobacco, egg-plant, and chilli. Of these, tomato and black nightshade* are the only ones likely to play a part in the spread of mosaic to tobacco crops. The symptoms on these plants are similar: a light- and dark-green mosaic pattern on the leaves and a slight stunting of the plant. Leaf markings are less distinct than they are on tobacco and are sometimes difficult to distinguish. On tomatoes the leaves are sometimes narrowed and distorted.

* Black nightshade is a common weed of gardens and cultivated land. It is often erroneously called "deadly nightshade."

*Increase of the Virus in Diseased Plants.*

Although only a very small quantity of the virus is necessary to bring about infection of a healthy plant, it increases rapidly after infection has taken place. Thus a well-grown healthy plant may become infected if touched with a finger on which a small quantity of the mosaic virus is present. Three weeks later this plant would yield sufficient virus to infect every tobacco-plant grown in New Zealand.

It has been pointed out that the symptoms of mosaic show only in new growth, and that a plant infected late in the season may show mottling only in the laterals. In such plants the concentration of the virus is as high in the older unmottled leaves as in young leaves showing mosaic symptoms. Thus a plant which has shown symptoms in the laterals only, will, after lateraling, appear healthy and yet be a source from which the disease may be readily spread.

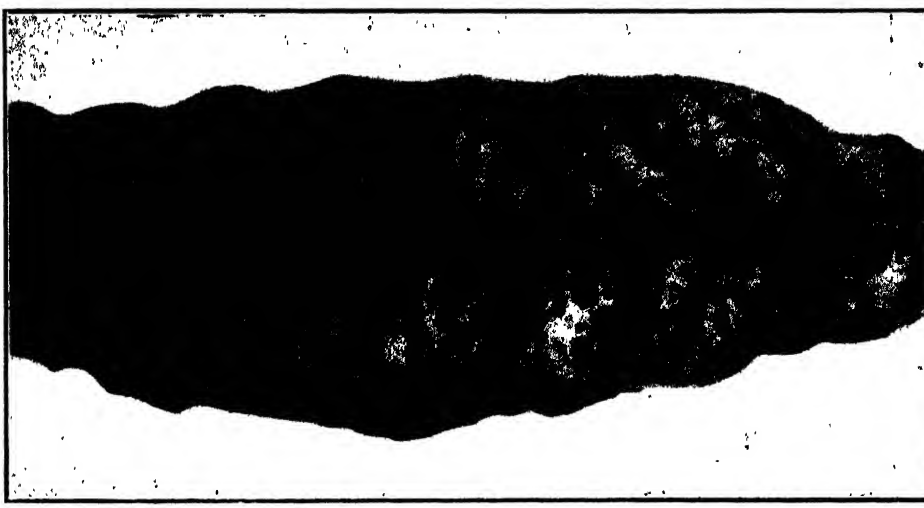


FIG. 5. LEAF-SPOTTING CAUSED BY TOBACCO-MOSAIC ON A LEAF FROM A PLANT OF THE "BURLEY" TYPE.

[Photo by H. Drake.

In America it has been found that the virus is still active in the sap from diseased plants after five years, and that it may persist in the dried leaf for over thirty years. The evidence available shows that the disease may persist for several years under New Zealand conditions.

*Occurrence in Smoking Tobacco.*

Tobacco-mosaic is not destroyed by the normal curing and manufacturing processes, and may be present, therefore, in prepared tobaccos. Overseas it has been shown that the disease is carried in many brands, and in some places smoking and chewing tobaccos are considered to be mainly responsible for the introduction of mosaic into the crops.

Experiments carried out at Palmerston North have shown that of nine samples of home-cured tobacco and sixteen samples, including nine brands, of manufactured tobacco, all carried mosaic infection. Home-cured tobacco carries the disease more readily than manufactured

tobaccos. In some localities in America control of mosaic has been secured, in conjunction with other necessary precautions, by issuing to workmen tobacco which has been treated by heat to destroy the virus.

*Heat Treatment.*

It has been found both in New Zealand and in other countries that, when heated for ten minutes, 195° F. is the lowest temperature at which the mosaic virus can be killed. Therefore, in order to destroy the disease it is necessary to maintain tobacco at a temperature in excess of this for ten minutes.

Heat does not penetrate readily into tobacco, and experiments have shown that a sufficiently high temperature cannot be secured by heating it in a tin either above or partly submerged in boiling water. A satisfactory way of destroying mosaic is to heat the tobacco in steam


FIG. 6. EFFECT OF TOBACCO-MOSAIC ON THE YIELD AND QUALITY OF LEAF.

Each bundle is the product of six plants. A " Burley " variety.

A. Leaf from healthy plants.
B. Leaf from plants inoculated with tobacco-mosaic on 17th December, 1934.
C. Leaf from plants inoculated with tobacco-mosaic on 5th December, 1934.

[*Photo by H. Drake.*

under pressure. Tobacco in 2 oz. sealed tins may be successfully treated in steam at 10 lb. pressure for fifteen minutes. This method necessitates special equipment, as an autoclave is required to obtain the pressure.

Steam treatment under pressure darkens the colour of the tobacco and alters the flavour slightly.

*Infectious Nature of the Disease.*

Tobacco-mosaic is the most infectious plant virus disease known. The sap from diseased plants may be diluted to 1 part in 1,000,000 parts water and still bring about infection when rubbed on the leaves of healthy plants.

Infection can take place only through wounds, the disease gaining entrance most readily through very small injuries such as are caused by the breaking of leaf-hairs, which occurs whenever a leaf is touched. Thus, if the mosaic virus is present on the fingers, the mere touching of healthy plants is sufficient to infect them with the disease.

The ease with which infection may be brought about has been clearly shown by experiments carried out at Palmerston North. Sap from

FIG. 7. COMPARISON OF HEALTHY AND MOSAIC-INFECTED PLANTS.
Note stunting of plant and narrowing of leaves.

[Photo by H. Drake.

mosaic-infected plants was rubbed on the leaves of over 750 healthy tobacco-plants growing in the field, and all developed the disease.

*Spread of Tobacco-mosaic by Handling.*

In the field handling of the plants with contaminated fingers is the main method by which the disease is spread. Plants are handled a number of times during the season, affording many opportunities for the introduction and spread of the disease. Observations indicate that most of the infection takes place at the various times of handling—that is, at (1) pricking-out of seedlings into the beds, (2) pulling of plants from the beds and transplanting to the field, (3) topping, and (4) lateraling.

The hands may become contaminated with the virus from (1) infected tobacco-plants already present in the crop, (2) smoking tobacco, (3) other infected plants such as tomatoes or black nightshade, (4) infected leaf or other plant-remains left over from the previous season.

Experiments were carried out to determine the extent to which the disease was spread during lateraling. Two workmen, after lateraling a number of infected plants, each lateraled one row of thirty-five healthy plants. When the crop was inspected three weeks later 83 per cent. of these plants had developed mosaic.

FIG. 8. TOBACCO-PLANTS INFECTED WITH TOBACCO-MOSAIC.

Healthy plants on right. Portion of the 1934–35 yield trials. Variety "Warne."

[*Photo by H. Drake.*

### *Rapid Spread towards the End of the Season.*

The amount of infection in a crop increases rapidly from the topping stage until the end of the season. Thus a crop which is showing 5 per cent. noticeable infection before topping may be 100 per cent. infected by harvest-time. Although the bulk of the leaf from such a crop may be normal in appearance and of good quality, it nevertheless carries mosaic infection.

The virus of tobacco-mosaic may be removed from the hands by thorough washing. It is not easily removed in this way, however, and to be effective the washing must be very thorough. It is advisable to use warm water, plenty of soap, and a nail-brush. Then, to remove all traces of the virus, the hands should be rinsed in running water or a change of water. Care should be taken not to recontaminate the hands from towels carrying infection.

### *Tobacco-mosaic may remain Alive in the Soil.*

The mosaic virus may remain alive in the soil during the winter and bring about infection of healthy plants in the spring. In rare instances it may survive two winters. The disease usually persists in the roots and stalks from infected plants of the previous season, but it may also occur in the soil in the free state. As a rule the amount of infection which takes place from the soil is small although occasionally it may be as high as 25 per cent.

Experiments carried out at Palmerston North have shown that where tobacco-mosaic has been present in a seedling-bed it may remain in the soil and infect the seedlings in the following season. In an instance where seedlings were pricked out into such a bed the plants, although they did not show the disease while in the seedling-bed, showed over 11 per cent. infection after they had been transplanted to the field.

It has also been found that where mosaic-infected plants growing in the field are removed and replaced with healthy plants a high percentage of the replants develop the disease. Thus, of 129 healthy plants replacing diseased ones, 72 per cent. became infected.

Although many virus diseases are spread by insects, the results of investigations here and in other countries indicates that tobacco-mosaic is rarely if ever carried in this way.

In other countries it is generally held that tobacco-mosaic is not carried in the seed of tobacco. An investigator in Russia has claimed, however, that it may be carried in the dust which is often mixed with the seed. Preliminary trials in New Zealand suggest that the disease may sometimes be carried to a small extent either in or with the seed. Further trials are necessary before this question can be considered settled.

It has been shown in experiments at Palmerston North that tobacco-mosaic is carried in a small percentage of seed harvested from infected plants of tomatoes and black nightshade.

## MEASURES FOR THE CONTROL OF TOBACCO-MOSAIC.

In outlining measures for its control it is stressed that tobacco-mosaic is very infectious and that it is essential to take the very greatest precautions to prevent its spread. The disease may be introduced in a number of ways, and field observations in the Motueka District indicate that the method of introduction varies from crop to crop. Control measures which are successful in one crop may, therefore, fail in another, so it becomes necessary to carry out all measures with equal thoroughness.

Control of tobacco-mosaic presents two problems: Prevention of introduction of the disease to the crop and prevention of spread after the disease has appeared.

### *A. Prevention of the Introduction of Tobacco-mosaic to the Crop.*

There are three ways by which the disease may be introduced: (1) With the seed; (2) through the soil; and (3) by human agency.

(1) *With the Seed.*—At present no measures are taken to ensure that the seed used on New Zealand is taken from healthy plants. This will become a necessary precaution if it is shown ultimately that tobacco-mosaic is carried with the seed.

(2) *Through the Soil.*—The disease is frequently introduced into the crop through the soil. Plants may become infected by means of contaminated soil in (*a*) seed-boxes, (*b*) seedling-beds, and (*c*) field.

(*a*) Seed-boxes : Soil used in seed-boxes should be steam-disinfected. When steam-disinfected soil is not available fresh soil should be obtained from land which has not been in tobacco or tomatoes for at least two years.

(*b*) Seedling-beds : Beds in which mosaic has appeared should not be used the next season unless the soil is replaced or disinfected with steam. New beds should be prepared on land which has not been in tobacco or tomatoes for at least two years.

If plants in a seedling-bed remain free from mosaic, the bed may be used a second season. All tobacco-plants should be removed as soon as possible after field planting has been completed, and the bed kept free from weeds until it is prepared for the new season.

(*c*) Field : The disease is carried over in the soil mainly in the roots and stems of the previous season's crop. The virus may also be leached out of such plant-remains and persist in the soil in the free state. Therefore all roots and stems should be removed from the field as soon as possible after the completion of harvesting, and, after drying in the sun, should be burnt.

(3) *By Human Agency.*—A great deal of infection with tobacco-mosaic takes place through the handling of plants with contaminated fingers. The many handlings to which the plants are subjected during the growing-season affords excellent opportunities for the introduction of the disease. The fingers of workmen may become contaminated by handling—(*a*) home-cured or manufacture tobaccos ; (*b*) rubbish from previous season's crop ; (*c*) cured leaf (often discard) left in sheds from previous season ; or (*d*) other infected hosts.

(*a*) Home-cured or Manufactured Tobaccos : Since practically all tobacco carries infection, smokers working with plants should smoke only sterilized tobacco.* This precaution should be taken from the commencement of pricking-out of seedlings into the beds until harvesting, and both at work and at home.

(*b*) Rubbish from previous Season's Crop : Owing to the high percentage of infection at the end of the season all tobacco-plant remains must be regarded as infected and capable of carrying the disease over to the next season. Therefore, after drying of the leaf is completed, all tobacco refuse should be collected from in and around the kilns and sheds and destroyed by burning.

(*c*) Cured Leaf : All saleable leaf should be disposed of at as early a date as possible. Unsold leaf should be stored and not left lying in the sheds. All discard leaf should be burnt as soon as grading is completed.

(*d*) Other Infected Hosts : Mosaic sometimes spreads to tobacco from infected tomato or black-nightshade plants.

If tomatoes are grown on the farm every care should be taken to see that they do not become infected. Thus all seed sown should be from

* Until such time as arrangements can be made to have tobacco sterilized in the Nelson District, growers may have their tobacco treated free of charge by forwarding it to the Plant Diseases Division, Box 16, Palmerston North Factory-made cigarettes cannot be treated.

healthy plants and the same precautions taken as when dealing with tobacco. As the symptoms on tomatoes are sometimes very slight and may not be noticed, the hands should be thoroughly washed after working with this crop.

On account of the inconspicuous symptoms displayed, black nightshade may act as an unsuspected source of infection. Mosaic is more likely to be present on this plant because of the ability of the virus to carry over in the seed. Special care should be paid to the eradication of this weed in the seedling-beds and surroundings. If plants are pulled the hands should be washed before again working with tobacco.

*B. Prevention of Spread after Infection has taken Place.*

Once tobacco-mosaic has been introduced it may spread rapidly through the crop. Spread takes place through the soil and by workmen.

(1) *Through the Soil.*- Although tobacco-mosaic is not known to pass from diseased to healthy plants directly through the soil, it does spread from infected plants to healthy replants. It is suggested, therefore, that when making replants the infected plant be removed complete with a large shovel-full of surrounding soil. Before replanting the hole should be filled with soil from between the rows.

(2) *By Workmen.*- This is the commonest method of spread of tobacco-mosaic Unless a great deal of care is taken each operation which entails handling of the plants may bring about a marked increase in the amount of the disease

Before pulling plants for setting out in the field the seedling-beds should be carefully inspected. If only a few infected plants are found, these, together with a group of surrounding plants, should be removed and destroyed. Where there are many infected plants in a bed it is inadvisable to set out any plants from it. The person doing the pulling should watch carefully for diseased plants, and when one is discovered it and a group of healthy plants surrounding it should be left unpulled. If an infected plant is accidentally pulled the person who has handled it should wash his hands before taking out any more healthy plants.

After plants have become established in the field they should be carefully inspected for mosaic. Plants showing infection at this stage do not produce any saleable leaf, and furthermore act as a potent source of infection for the rest of the crop. They should be removed and destroyed and their places filled with healthy replants. Several inspections should be made at seven- to ten-day intervals.

The disease may be spread on implements during cultivation, so as much care as possible should be taken to prevent them from rubbing against the plants.

If tobacco-mosaic is present in a crop a great deal of spread is liable to take place during topping and lateraling operations. To keep the amount of spread down to a minimum, one person should go through the crop ahead of the rest of the workmen and top or lateral all infected plants. This should be practised even late in the season when it is considered that mosaic will no longer affect the yield or quality of the crop, for, by keeping down the amount of infection, there will be less disease to carry through to the next season.

During all stages of growth of the crop workmen should be careful to thoroughly wash their hands after handling diseased plants. To be effective washing must be very thorough, it being advisable to use warm water, a nail-brush, and plenty of soap. After washing, the hands should be rinsed in running water or a change of water.

### Summary of Control Measures.

(1) Use steam-disinfected soil in the seed-boxes.

(2) Do not use a seedling-bed for a second season if tobacco-mosaic has been found therein.

(3) Establish new beds on ground which has not been in tobacco or tomatoes for at least two years.

(4) Keep the beds and surroundings free from weeds and stray tobacco-plants.

(5) Inspect seedling-beds prior to pulling plants for field planting, and remove and destroy any infected plants. If much mosaic is present in a bed do not set out any plants from it.

(6) Workers handling plants should smoke only sterilized tobacco or be non-smokers.

(7) Avoid contamination from other hosts. To this end keep tomatoes free from mosaic and eradicate black-nightshade plants.

(8) Remove and destroy diseased tobacco-plants as soon as they are noticed in the field.

(9) Remove the soil surrounding the infected plants when replacing them and fill in with clean soil before replanting.

(10) Avoid handling infected plants when working with healthy ones.

(11) Thoroughly wash the hands with soap and water to remove contamination whenever infected plants have been handled.

(12) Plough out roots and remove them from the field, together with stems and old leaves, and destroy by burning.

(13) Destroy all discard leaf as soon as possible after curing and grading is completed.

(14) Remove all tobacco from the farm at as early a date as possible.

In a strain trial at Palmerston the influence of clover on the relative value of cocksfoot and rye-grass is very marked. Throughout the major portion of the trial, which was sown with a mixture of grasses and clovers, there is a good healthy mixed sward, with rye-grass the dominant and best producing grass. Cocksfoot is present, but compared with the rye-grass is of much less value. On the " no clover " plot rye-grass is also dominant as regards ground cover, but cocksfoot is much the better producer and in the circumstances is the better grass. All plots have been liberally top-dressed with lime and super. This top-dressing appears to be thrown away as far as the " no clover " plot is concerned at present.—*Fields Division.*

# SEASONAL NOTES.

## THE FARM.

### Special Feed Provision of Seasonal Importance.

A SEASONAL matter of great moment is consideration of the steps to be taken during the coming year in regard to the provision of special feed to supplement the pastures during those periods when the feed directly available from pastures is likely to be below the economic requirements of the number of stock that should be carried to bring about advantageous consumption of the main supply of feed, which is that harvested directly by the animals themselves from the pastures

In considering this matter the dairy-farmer is confronted by two major facts. Firstly, even the average dairy cow calls for a higher standard of feeding than do other classes of cattle or sheep, while the good dairy cow is particularly exacting and exceptional in its requirements. One reason for this emerges clearly from a comparison of the requirements of the breeding-ewe and the dairy cow Like the dairy cow the breeding-ewe calls for liberal supplies of high-quality milk-producing feed in preparation for and during the period of its useful production of milk The vital difference between the cow and the ewe is that the milk-production of the cow should continue at a relatively high level for several months after that of the ewe, and this in the latter part of the summer and autumn, when the pastures frequently do not readily or naturally provide feed that is fully suitable for a high level of milk-production. Another reason for the comparatively high standard of feeding required by the dairy cow lies in its high standard of production. An indication of this is obtained by comparing the steer putting on the satisfactory daily gain of 2 lb. live weight and the cow giving the moderate yield of 3 gallons of milk daily; the former elaborates from its food 1½ lb of dry matter daily, the latter 3¾ lb. daily—two and a half times as much. It is notorious that the good dairy cow frequently is fed substantially below its economic requirements. The facts just considered assist in explaining why this is so. The modern good dairy cow is a relatively recent development in the world's farming. Hence, in the evolution of traditional live-stock feeding practice the needs of the modern dairy cow were not taken into account - indeed, they could not be taken into account, for the counterpart of the modern dairy cow did not exist. Hence it follows that the experience which taught how to feed well either cattle—as just cattle—or sheep is far from enlightening as to the needs of the dairy cow. Better feeding of good dairy cows may be expected to arise from fuller and wider realization of their special needs.

The second fact of importance in regard to the dairy-farmers' provision of feed is that the well-managed sow is in an important respect more exacting than the good cow in its requirements of feed. This originates in the fact that in the feed-supply needed by a sow which rears two litters annually there are two peak periods, and while one of these may coincide with the period when cheap supplies of pig-feed, such as dairy by-products, are most freely available, both of them of necessity cannot do so. Further, the sow, because of physiological differences between the sow and the cow, should receive feed of even better quality, in respect to high digestibility and low content of fibre, than that given the dairy cow. Summed up, in the cow and the sow the dairy-farmer handles stock which require a feed-supply (*a*) that should be of comparatively generous quantity and good quality, and (*b*) that should be maintained for an exceptionally large part

of the whole year. These two features of the dairying feed-supply should be given close attention in planning the year's production of feed. In this connection a point of basic importance is that the variations from month to month in the feed requirements of stock do not correspond with the variations in the direct yield of feed from month to month by typical grassland.

There is evidence that many sheep-farmers profitably could make greater provision of special supplementary feed than they are accustomed to make. It is well known that lambing percentages are affected materially by the condition of the ewes at service. It is known that superior results are obtained when "flushing" of the ewes is carried out—*i.e.*, when the ewes are in rapidly improving condition when they are served. In some districts favoured by timely rains the growth of grassland allows of flushing to occur almost naturally and with a minimum of effort on the part of the farmer to bring it about. But in districts with a climate similar to that of much of the Central Hawke's Bay or of Canterbury flushing usually calls for the use of feed specially provided for the purpose. Recent investigations in Hawke's Bay point to the possiblity of increasing the lambing percentages at times by 6 per cent. to 10 per cent. by suitable flushing. In limited experience in the South Island, under irrigation which facilitates the provision of flushing-feed, even greater increases in lambing percentages have been credited to flushing.

Relative to the provision of special supplementary feed, many sheep-farmers probably with advantage could give more attention to the fact that lambs that are kept thriving are seldom troubled seriously with internal parasites. Since at least the beginning of this century, veterinarians and others have pointed to the value of good feeding in lessening the ravages of such parasites. The position recently has been stated strikingly by Dr. Fraser, of Rowett Institute, Aberdeen, thus: "My considered advice is to look after the sheep, and the sheep will look after the worms." While this is not advanced as a full statement of the position, in so far as it relates to proper feeding, it is in accord with the advice of New Zealand authorities.

The winter feeding of breeding-ewes often could be improved with profit. A direct step towards such improvement would be additional provision of special feed to supplement the pastures. There is evidence that improved winter feeding of ewes at times would lessen troubles and losses at lambing, and that it would increase the number and the weight of the lambs fattened "off the mothers."

The foregoing remarks are designed to indicate the practical importance to both the sheep-farmer and the dairy-farmer of the proper provision of special supplementary feed with the object of making the supply correspond with the requirements of feed from season to season throughout the year. On all farms, except those on which arable crops are dominant, the question of special supplementary feed is indeed of prime importance at this time of the year. Measures which can be made to assist greatly in meeting the position—ensilage and special cropping—are ones for which preparation usually should be in progress about this time.

## Ensilage.

The two main tasks relative to ensilage that at this stage call for attention are—

(1) *The Closing of Suitable Pastures.*—There should be no delay in the closing of fields for silage. A common error is the making of silage at a later date than is desirable. One of the advantages of ensilage in comparison with hay-making is that silage usually may be removed early enough to allow of a substantial leafy aftermath before the customary dry summer period during which such an aftermath frequently is especially useful. As a rule, it is profitable to top-dress fields with superphosphate just before closing them for hay or silage if they have not been top-dressed during the previous year.

(2) *The Construction of Pits or Trenches if these are still to be farmed.*—Suitable sites are to be found on a great many farms for pits or trenches, which usually can be made quite inexpensively. Hence, as a rule, it is not difficult to provide sufficient pits or trenches located at different points on the farm in such a way that the necessity for using the same pastures frequently for ensilage may readily be avoided. If convenient terraces on which pits can suitably be placed are not available, then trenches which quite satisfactorily can be located on level paddocks may be employed. In trenches, which are simply shallow pits, silage has been saved with the wastage so slight as to be immaterial. When the pit or trench method of ensilage can be adopted it usually should be followed, as it not only minimizes wastage of crop material, but also lessens the amount of labour and equipment required. Trenches have been used successfully in soils which are far from well drained—*e.g.*, heavy level soils in districts of 40 in. to 50 in. of rainfall annually and with no artificial drainage, but despite such experience it is naturally advisable to avoid as much as possible poorly drained sites for trenches, as bad drainage in the vicinity of the sites tend to hamper the carting out of the silage for feeding.

The plans for the production of special feed often quite well may provide for haymaking as well as ensilage When surplus grass is being harvested during good haymaking weather, it is then good practice to turn such grass into hay instead of silage ; hay is more suitable than silage for feeding in conjunction with roots, which should be used on many of the farms on which ensilage also is well worth while.

### Special Forage Crops.

Often the needs in respect to special supplementary feed cannot be met fully by ensilage and haymaking. In sheep-farming the flushing of ewes or the feeding of hoggets possibly may be best carried out by the use of special crops. In dairying the provision of sufficient highly digestible feed in the latter part of the summer is particularly important ; at times the feed available directly from grassland commences to fail shortly after Christmas as a ration for reasonably productive dairy stock. While it is not difficult to supplement the pastures suitably during the latter part of January and in February, it is not altogether easy always to remedy the weak position that occurs a little earlier. Fresh leafy growth such as an aftermath on an ensilage field or a second growth on a lucerne area are likely to be specially useful at this period. When there is no certainty of sufficient leafy feed from such sources, it generally is advisable to sow in October an area of quickly maturing soft turnips, such as Purple Top Mammoth, for use early in the New Year.

In general at this time of the year it is particularly desirable to push ahead as rapidly as possible with the preparatory work for such crops as mangels, rape, chou moellier, and other kales, lucerne, and swedes. There is much evidence from the field that the thoroughness of cultivation is more frequently and more gravely a limiting factor in crop-yields than is commonly believed, that full benefit is not received from good seed and suitable fertilizers because the cultivation is the weak link in the chain of factors that constitute efficient crop-culture.

The acreage devoted to the mangel in the Dominion in 1935–36 was higher than usual, but sales of seed suggest that a decrease in acreage took place last season. Having regard to all the current circumstances the mangel actually warrants increased rather than decreased attention. Over a wide range of conditions efficient culture results consistently in yields of 50 tons or more of mangels an acre. It is of seasonal importance that success with the mangel depends upon high fertility and thorough cultivation. Hence, if land intended for mangels is not naturally rich it should be made so by

the use of farm or artificial manure or both, and due attention should be given to the fact that the mangel responds profitably to abundant and thorough cultivation both before and after the sowing of seed.

Chou moellier or marrow stemmed kales and other kales have at times been sown in October with good results for the provision of feed from the middle of January or the beginning of February. Later sowings to provide feed in the following autumn and winter are usually advisable. Chou moellier continues popular among both sheep-farmers and dairy-farmers. It requires the soil conditions which suit the cabbage—*i.e.*, high fertility, which it well repays. It usually responds profitably to a dressing of 2 cwt. to 3 cwt. an acre of superphosphate on good land, a dressing which as a rule it is advisable to supplement with 2 cwt. to 3 cwt. an acre of blood and bone on poorish land which has not been enriched by farmyard or similar material that is excellent for chou moellier. The popularity of chou moellier is due not only to its good feeding and good potential yield, but also to the three following facts: (1) Its total labour requirement is relatively small; (2) it is highly resistant, though not immune, to club-root, and so can be grown safely where swedes would fail because of the ravages of club root; (3) it can be fed *in situ* with the minimum of waste under wet conditions in the winter.

On free soils the carrot proves distinctly productive and useful under suitable management. Of the roots commonly grown the carrot has the greatest feeding-value per ton, and yields of over 40 tons an acre are not at all uncommon. The Guerande variety rightly appeals to many because it may be grown in such a manner that thinning is inadvisable, and, because of its habit of growth, digging is unnecessary. Ordinarily it should be grown at the rate of 1 lb. to 1½ lb. of seed an acre, in rows 18 in. to 24 in. apart, and intercultivated as much as possible, but it may be grown without intercultivation when sown at the rate of 1½ lb. of seed an acre in rows 14 in. apart. It is considered good practice, especially for sheep, to sow it on low ridges obtained by rolling after the ordinary ridger. Other varieties popular because of their consistently good yields are Matchless White, Barriball, and White Belgian. Preparatory cultivation is most generally commenced between mid-August and mid-October. The seeding usually adopted is 1 lb. to 1½ lb. of seed an acre in drills 14 in. apart, but very good yields have resulted from sowing in drills 18 in. to 24 in apart. A popular manurial dressing is a mixture of superphosphate and bonedust at the rate of about 4 cwt. an acre.

Preparatory cultivation for lucerne, if not already in progress, should be started without delay. Though the area of lucerne in the Dominion has increased by about 50 per cent. in the past decade, lucerne could, with much profit, be grown very much more widely in both the North Island and the South Island. Much information about the establishment and the general culture of lucerne is given in Bulletin No. 155, which may be obtained free on application to any office of the Department of Agriculture. The appeal of the crop is particularly wide, as it has been used with good results in New Zealand in the feeding of sheep, cattle, pigs, poultry, and horses. The history of lucerne-culture in New Zealand contains many instances of failures, which in the light of the knowledge now available could have been avoided easily—indeed, at times the practices adopted with lucerne were fitted to beget failure rather than success. Because of the later additions to our knowledge, lucerne to-day is being grown successfully over a wide range of soils and climates in New Zealand.

### The Potato Crop.

In many districts the main crop of potatoes should be sown in October Of outstanding importance is the use of "seed" healthy in all respects. The most serious form of disease is carried in the tubers. Knowledge of

this form of disease is incomplete—no visible causative organism is known—and the term virus is applied to it. Several forms of virus disease are known, and an important feature common to them all is that while the symptoms can be seen readily in the foliage they cannot be seen in the tubers, and so it is impossible to tell by inspection of "seed" whether it is healthy or suffering from a virus. The official seed-certification carried out by the Department of Agriculture gives much attention to the amount of virus visible in the foliage of the parent crop at the time of field inspection, the objective being to make available lines of potato "seed" with relatively small amounts of virus infection. Hence, as a rule, the only safe course is the use of certified seed from crops where the virus incidence is known to be small A concrete illustration of the value of certified seed is given in official data published by the Government Statistician, and based on returns supplied by farmers. The data relate to 10,000 acres—the total Dominion crop approximates 22,000 acres—grown throughout the Dominion, about one quarter of this 10,000 acres being in certified seed, the average yield an acre from certified seed being 7·43 tons, while from uncertified seed it was 5·95 tons. Hence an increase of 25 per cent in yield is associated with the use of certified seed.

The following varieties are of well-established merit: Aucklander Short Top (usually grown in the North Island as Sutton's Supreme), a second early which rightly is very popular, since it consistently gives satisfactory yields of good keeping and cooking quality, but it bruises rather easily in handling, Aucklander Tall Top, similar to Aucklander Short Top, except that it is later, being a main crop; Dakota, a standard main-crop variety that generally does well on medium land in Canterbury; Arran Chief, good lines of which should be popular on heavier land; King Edward, a potato of outstanding quality, which in general has not yielded satisfactorily except in Southland; Epicure, an early variety which can be recommended when certified seed is to be used.

—*R P. Connell, Land Utilisation Officer.*

# THE ORCHARD.

## Spraying.

No hard and fast rules can be laid down for the spraying of fruit-trees, as the programme to be followed largely depends on the climatic conditions prevailing during the season. The following general programme, giving the different periods of application and strengths of the sprays recommended, should act as a guide to growers

The first application of spray after the trees have commenced growth, known as "foundation spray," is most important, and on no account should be omitted by growers. The first spray should be applied during the month of September, the dates varying in the different districts :—

***Apples*** :—

(1) Green-tip Period : Bordeaux mixture 5–4–50; lime-sulphur 0·5 per cent. (1–30).
(2) Open-cluster Period : Lime-sulphur 0·2 per cent. (1–75); or lime-sulphur (1–50) plus colloidal sulphur 2–100.
(3) Petal-fall Period : Lime-sulphur 0·1 per cent. (1–500) plus colloidal sulphur 2–100 plus lead arsenate 1½–100 plus hydrated lime 3–100.
(4) Ten to Twelve Days later : Same as No. 3.
(5) Fifteen to Eighteen Days later : Lime-sulphur 0·083 per cent. (1–180) plus colloidal sulphur 2–100 plus lead arsenate 1½–100 plus hydrated lime 3–100.

(6) Subsequently at Fifteen to Twenty Days' Intervals till Mid-January, and later if necessary : Same as No. 5.

The dilutions given in these notes for lime-sulphur refers to a specific containing 15 per cent. of polysulphide content, calculated on the basis of weight. During January and February apply summer-oil at strength 1–100 to 1–150. Two applications at close intervals for the control of red mite, &c. These sprays should not be applied within fourteen days of sulphur sprays.

Slight variations can be made from the above programme when spraying special varieties. For instance, with Cox's Orange Pippin lime-sulphur can be dropped after the first two sprays, using colloidal sulphur at strength 2–100, reducing to 1–100 as the season advances. With Jonathan and Dunn's Favourite colloidal sulphur may be substituted for lime-sulphur according to weather conditions.

*Pears* :—

(1) Green-tip : Bordeaux mixture 5–4–50.
(2) Pink Period : Bordeaux mixture 3–4–50.
(3) Fruit-set Period : Bordeaux mixture 3–4–50 plus lead arsenate 1½-100.
(4) Later, at Intervals : Lime-sulphur 1–180 plus lead arsenate 1½–100.

Exception can be made with the Winter Cole, P. Barry, and Josephine varieties, the following sprays being recommended :—

(1) Green-tip : Bordeaux mixture 3–4–50.
(2) Pink Period : Lime-sulphur 1–75.
(3) Fruit-set Period : Lime-sulphur 1–180 plus lead arsenate 1½–100
(4) Later, at Intervals : Same as No. 3.

*Stone-fruits* :—

(1) Bud-movement Period : Bordeaux mixture 5–4–50.
(2) Pink Period : Bordeaux mixture 3–4–50 or lime sulphur 1–100.
(3) Fruit-set Period : Lime-sulphur 1–180 plus colloidal sulphur 2–100.
(4) Intervals : Same as No. 3.

During January and February it may be advisable to apply nicotine sulphate at strength 1–800 plus 3 lb. soft soap for the control of black and green aphis, repeating the application in seven to ten days.

## Cultivation and Manuring.

Ploughings, whether autumn or spring, should now be receiving attention if the best results are to be obtained. The breaking-down of the soil by disk, harrow, and cultivator does much to aerate the soil and to create a fine tilth so necessary during any dry periods that may follow during the growing-season. Cultivation round the trees is an important operation too often neglected. The thorough working of the soil at this time of the year not only makes cultivation much easier during the balance of the season, but has a great influence on the growth of the trees and the crops carried. Every effort should be made to harrow the orchard after rain to break the crust, to prevent drying out, and to promote capillarity between topsoil and subsoil so necessary for the welfare of the trees. Further delay in the application of manures may mean that the trees will not receive the benefits to be expected during the present growing-period.

## Planting.

New plantings should be proceeded with as soon as the soil is in a suitable condition to receive the trees. Should the ground be cold and wet, it will be preferable to defer planting for a week or two to ensure that the young trees receive no setback at the start. All broken and bruised roots should be cut off, and the top cut back sufficiently hard to form a good

framework for the future tree. The young trees should be placed on a slight mound within the hole so as to give the roots a downward inclination—roots well spaced and the soil well pressed round the roots. The trees should be planted firmly. A small application of blood and bone manure mixed with the soil to be used for filling in the hole will materially help in giving the roots a good start for the coming season.

### Grafting.

The time for the renovation of fruit-trees by means of grafting is now approaching; in fact, providing the season is suitable, grafting may be done in some parts towards the end of September, but, as the majority of the work is done in October, further notes on this subject will appear next month. It is necessary to see that the scions to be used in the operations are kept in a dormant condition, free from disease, and that the buds, from which the new growths will start, are in a healthy condition

—*George Stratford, Orchard Instructor, Motueka.*

### Citrus Culture.

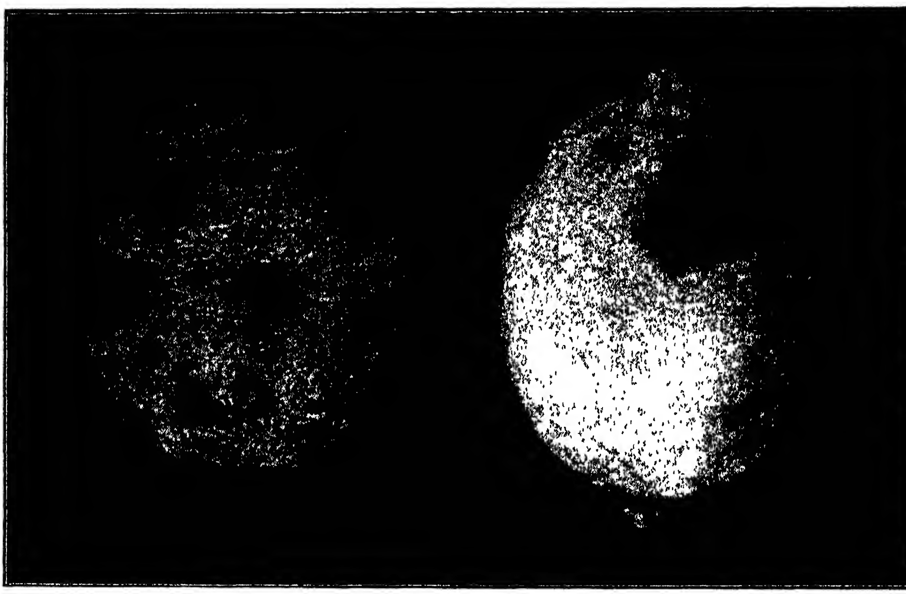
*Reworking.*—Most lemon and orange orchards contain a number of trees that produce fruit of an inferior type consistently year after year. Although a percentage of the fruit from such trees may be marketable, it is seldom wise to retain such trees. In most cases it is best to work the trees over with buds taken from trees that consistently produce heavy crops of high-quality fruit. The same recommendation applies in the case of unsuitable varieties.

The standard method of propagating citrus is by budding, which is much simpler, quicker, and more economical of budwood than any method of grafting. Citrus can be budded whenever the bark will lift, which can be expected in the months of November and March Unlike that of stone-fruits, two-year-old wood of citrus is quite suitable for budding, and often buds inserted into limbs that are three and four years old will prove satisfactory. However, one-year growth that is well matured will usually give best results. When it becomes necessary to rework mature trees, the best method is to remove all limbs about 1 ft. above the main fork of the tree. This should be done as soon as the spring growth commences, although where this is not possible the work of cutting back can be proceeded with until several months later The vigorous shoot-growth that arises from the remaining portion of the tree should be sufficiently mature to receive the buds before growth ceases the following autumn. These shoots are then thinned to the required number and the buds inserted near the base of the shoots Greater care and skill is required in the budding of citrus than in most other kinds of fruit-trees, and even under ideal conditions a skilled operator will seldom secure 100 per cent. of "takes."

Budding is accomplished by the insertion of a shield-shaped bud into a "T" or an inverted "T" slot cut in the bark of the one-year shoots. It is claimed that the latter method keeps out the moisture better. A sharp knife is essential. The bark is then lifted slightly at the junction of the vertical and horizontal cuts. The bud is next cut from a stick of mature one-year wood, with the basal end held away from the operator. The cut is made towards the operator with the knife blade almost parallel to the axis of the bud-wood. This will give a shield-shaped piece of bark and wood about ¾ in. to 1 in. long, with a smooth and flat cut surface. The wood portion should not be "scooped" out. The bud is inserted beneath the bark and then pushed as far as possible along the vertical cut in the stock.

In selecting bud-wood, well matured plump shoots of the type that usually produce fruit should be selected. Flat or angular growth is undesirable, likewise vigorous water-shoots.

A good grade of calico torn into strips about ½ in. wide and impregnated with grafting-wax is excellent for wrapping. The binding is started below the bud and the calico is wrapped firmly in a spiral manner until the entire length of the vertical cut is covered. The actual bud is completely covered in the process. After about fourteen to seventeen days the bud is examined, and if still green and showing callous formation the binding can be removed. Any failures can be rebudded immediately if the bark still lifts readily. If the bark by this time is adhering to the wood, further budding must be delayed until the spring growth commences. When the bud is inserted in the autumn the top is removed as soon as the spring growth commences by cutting just above the bud, and with spring budding as soon as the binding is removed.



THE COMMON FORM OF GREEN-SPOT.

"Green-spot" is the name given to markings which are often produced on lemons that are harvested when of a green or silver colour. The spots usually vary from a ¼ in. to ¾ in. in diameter, and are caused by the fruit becoming bruised at some stage before it is fully coloured. These bruises, when made, are not readily seen, except under close examination, consequently growers not curing their own fruit often fail to realize that such injuries have occurred. Fruit that is picked when in a wet condition is believed to be most readily affected. The accompanying photograph illustrates the common form of green spot.

*Blue-mould (Penicillium italicum)*.—This fungus disease often causes considerable loss in citrus fruits both during the curing and in the interval between the packing and the sale of the fruit. During the months of October and November the disease is usually most troublesome, consequently special care should be taken with all fruit harvested at this time of the year. The fungus cannot enter a sound fruit unless it comes in actual contact with a decayed fruit. However, the slightest injury to the oil-cells is sufficient to allow the fungi to gain an entrance

to the tissues of the fruit. These injuries are so small at times as to be invisible to the naked eye. Lemons that are harvested in a yellow condition are particularly susceptible to attack. There is a tendency on the part of some lemon-growers to allow small fruits to remain on the trees for several weeks after assuming the silver-green colour, particularly during the late winter and spring months Little, if any, size-increase takes place in the fruit by this practice, and the risk of blue-mould infection is greatly increased.

—*P. Everett, Orchard Instructor, Gisborne.*

## POULTRY-KEEPING.

### Determination of Sex.

SEVERAL inquiries as to whether sexing is injurious have been received. In this connection it may be mentioned that in order to test out the effect of this operation the Department had a batch of chickens sexed on the 2nd September, 1935. The sexed pullets were reared separately. The average weight of the 204 one-day-old sexed pullets was 1·33 oz., as against an average weight of 1·47 oz. for 274 one-day-old mixed White Leghorn chickens, which would indicate that one-day-old cockerels are slightly heavier than one-day-old pullets. At six weeks old the 126 pullets which had been reared with cockerels averaged only 10·39 oz., as against an average of 12·66 oz. for the sexed pullets; thus showing that the sexed pullets grew better when reared by themselves. It would also indicate that sexing had no ill effects.

The approximate cost of feeding the chickens up to six weeks old was 2½d. each.

Forty of the sexed pullets, which were reared on a dry mash, were kept separate, and comprised one of five pens of forty pullets each. Each pen of birds was fed on a different ration, and the pen of sexed pullets laid more eggs during the test than any of the other four pens, which were made up of pullets that had not been sexed. After the test was over some of the birds were culled on account of their not being up to standard, just as any flock requires to be culled.

The rest of the hens are now entering their second laying-season, and they have shown no ill effects from the action of sexing.

It may be of interest to mention that the cockerels sexed from the batch of chickens in question were sold as day-olds. The purchaser reared them and kept the best for breeding purposes, and the results were quite satisfactory.

Judging from these tests, together with reports from poultry-keepers who have had large numbers of chickens sexed, it may be said that provided the work is done by careful, experienced operators, there is little danger of any ill effects.

In order to diagnose the sex of one-day-old chickens accurately and quickly, a person requires to be in practice, have good eye-sight, plenty of light, and a retentive memory. It is quite possible for an inexperienced person, especially if the light or eye-sight is not too good, to cause injury by applying too much pressure when sexing, and for this reason poultry-keepers would be wise to see that competent certificated persons only are engaged to do the work. At times, if ovarian trouble is experienced amongst sexed pullets, there is a tendency to think that the birds were injured while being sexed. Experience has shown, however, that if injury is done while diagnosing the sex the injured birds do not live long.

### Vent-picking.

Vent-picking is usually started by one hen picking the vent of another whilst it is in the act of laying. The picking causes bleeding and laying keeps the wound open. Protrusion of the oviduct often follows, or the wound becomes septic, when a whitish discharge comes from the vent. One bird will often start the trouble and cause almost an epidemic in a flock, for once birds acquire the taste for blood they seem to watch for other birds laying and then attack them. Treatment of victims is of little value. The best plan is to remove the culprit at once, if possible darken the nests, and keep the birds busy by increasing the depth of litter and scattering a little scratch feed about during the morning.

### The Season getting on.

On a general farm where only a small flock of poultry is kept and the hatching and rearing are done by natural means it is often difficult to get broody hens before this time. However, if not already done, every effort should be made to get all the chickens required hatched out as soon as possible.

September is looked upon as the best month of the year in which to hatch chickens, although many prefer August for hatching out chickens of the heavy breeds. Most of the large poultry-farmers try to get all their stock hatched out before the end of September, as experience has shown that, where large numbers of chickens are raised artificially, those hatched after September do not do so well, especially if the months of October and November are dry and warm. October hen-hatched chickens, especially of the light breeds, provided they are reared on fresh, sweet ground and are well looked after, should come into profit during April, but later-hatched birds do not as a rule do well, and seldom come into profit until the winter is over and eggs are cheap.

### Selecting Broody Hens.

As all broody hens do not make satisfactory sitters or mothers, care should be taken to select those of a quiet, docile temperament, and avoid the wild, nervous birds. Some hens are naturally clumsy, while others will sit for a day or two and then leave the nest, so for these reasons it is advisable to set the hen on some dummy eggs for a few days, and when satisfied the bird is really broody and of a gentle, quiet temperament, the more valuable eggs should be placed under her.

It is never advisable to set broody hens in the fowl-house or laying-shed, where they are liable to be disturbed by other hens, and where they are more likely to become infested with insects. The better plan is to build a light coop, with run attached, which can be moved on to fresh ground regularly. Such a coop can be cheaply erected and should give good service for a long time.

As more hen-hatched chickens and young turkeys are lost each year from the ravages of insects than from any other cause, it is advisable to see that all broody hens are treated for insects. A simple and effective method is to dip the end of a feather into nicotine sulphate and draw this under both wings and amongst the breast feathers, or dust the bird with insect-powder. This should be done when the bird is first set, and again in about ten days' time, but it is not safe to treat birds with chickens, or sitting hens just before the hatch comes off. The nest is best made on the ground, in order that the eggs may get moisture, otherwise the skin inside the shell is liable to become too dry and tough for the chicken to cut through. Make

the nest saucer-shaped, flat on the bottom, and just deep enough to cause the eggs to have a tendency to roll towards the centre, and flat enough to prevent them from piling up when the hen turns them.

Plenty of soft, pliable nesting-material, such as oat-straw or pine-needles, should be used. Should an egg get broken and the contents become smeared over other eggs, it is advisable to wash them in warm water and renew the nesting-material.

If sitting hens are closed in a coop or box, care should be taken to see that plenty of fresh air is available. They should be allowed to come off once a day. Grain, water, and grit are all in the way of food that sitting hens require. It is better to avoid giving mashes, especially sloppy food, as such are likely to cause looseness of the bowels, and the eggs to thus become soiled. The less sitting hens are disturbed the better, especially at hatching-time.

It seldom pays to help chickens out of the shells.

### Feeding and Care.

There are many different methods of feeding chickens, and in many cases success depends more upon how the birds are fed and cared for than upon what is fed. They should be fed at fixed times and at regular intervals, the first feed as early as possible in the morning and the last just before dusk. Feed fully and give plenty, but do not leave food lying about to become sour.

Chickens can only be expected to do well when their quarters are kept dry and clean. Dampness is dangerous as it is likely to cause filth from droppings, and disease may result.

As stale ground is responsible for a great deal of unthriftiness, it is advisable to arrange for chickens to be reared on fresh ground, apart from where adult birds have been running.

Those desiring full particulars of two methods of feeding chickens which have given good results at the Wallaceville Poultry Station may secure copies of same on application to the writer.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

## THE APIARY.

### Feeding and Water.

A CONSTANT watch should be kept on the stores in the hives. Usually at this period there is a steady drain on the food-supply to meet the incessant demand for brood-rearing. If an examination of the hives was carried out, as advised in my July and August notes, then the losses attendant upon spring starvation will have been avoided ; but it is not wise to neglect to feed where stores are short, as the spring is the most critical period for the beekeeper. The weather conditions are not always favourable for the bees to work the early spring blossoms, and in populous colonies the food-supply should be augmented, but only where there is a noticeable shortage. If there is a good queen in the hive she will usually begin laying as fast as weather conditions will permit, and it is a mistake to start feeding unless stores are very short, as it stimulates brood-rearing, and, when commenced, must be carried on until a natural flow sets in from the fields.

Abundance of stores is certainly required at this season, and if the beekeeper finds that additional food is required, it can be supplied in the form of combs of honey or as a syrup. The feeding of combs of

honey should not be practised unless the beekeeper is sure that his apiary is free from disease, as there is always danger of spreading disease by this method. No better substitute for honey has been found than cane-sugar, and it is far safer to use it at all times if the beekeeper is not satisfied as to the health condition of his apiary. Honey from an unknown source should never be fed. There are many feeders on the market. The division-board feeder is the best to use at this season, as it will serve the double purpose of feeder and division-board in cases where the colony is not strong enough to occupy all the frames in the hive.

In the spring months, when brood-rearing is at its height, bees require a good supply of clean water in the apiary. If this is not provided they are apt to become a source of annoyance at drinking-troughs and by congregating round domestic supplies. The brood requires a great deal of water in addition to pollen and honey. The amount depends largely on how much brood-rearing is going on, and to what extent nectar is coming in from the fields. If water is not close at hand many bees are lost in trying to obtain it, more especially as the weather is often changeable and boisterous in the spring.

Many simple contrivances can be made to supply water. "Simplicity" feeders make excellent vessels for the purpose, but they require to be filled frequently. To start the bees taking water from any particular place it is a good plan to slightly sweeten the first water given.

### When to start an Apiary.

One of the questions most frequently asked by the would-be beekeeper is, "When should I start beekeeping?" Probably no time is better than when the bees are swarming. If the beginner procures a good prime swarm, leaves it in a clean box for three days, and then hives it in a new hive, on new frames, with full sheets of foundation, he has made the best start it is possible to make in beekeeping. The leaving of the swarm in a box for three days is purely a preliminary measure in case there is any disease in the apiary, from which the swarm is procured. By the end of three days the bees will have consumed the honey they brought from their old home, and at the same time have disposed of the foul-brood germs (which are innocuous to the adult bee), and be ready and willing to be transferred to their permanent home to start brood-rearing in earnest.

As the bees will have become used to their box by the end of three days, it is as well to carry out the transfer with care. It should be done at sundown on the third day. The hive should be placed in position, a clean sack spread over the alighting-board and surrounding ground, and the hive-body raised from the bottom-board about an inch or so by means of a stone or piece of wood. The box should be firmly grasped with both hands, inverted over the sack as near the hive as possible, and the bees dumped with a brisk movement on to the alighting-board. One shake will dislodge the greater part of the cluster, and the few remaining bees can easily be shaken out and the box taken away. Be sure the queen is out of the swarm-box, and the bees will crawl in a steady stream into the entrance, their progress becoming more rapid as soon as the queen has entered the hive. When the queen is safely inside, the hive body should be lowered and the entrance slightly contracted.

It is advisable to place a feeder inside the hive. Even if the weather is good and a fair supply of nectar available, a few pints of good warm syrup fed a day or two after hiving will work magic with the new colony, and enable it to build up in time to yield a surplus when the main flow sets in.

The beginner should always start in the spring, and on no account should he attempt to commence with established colonies unless they are purchased from a breeder who guarantees his bees to be clean. Old hives are too apt to be homes of disease, and are only fit to be handled by the experienced apiarist.

—*E. A. Earp, Senior Apiarist.*

# HORTICULTURE.

## Vegetable Crops.

THE sowings for the month of October include the half-hardy crops of dwarf and runner beans, marrows, pumpkins, and cucumbers, also the winter crops of savoy and red cabbage, kale, cauliflower, and broccoli for planting out early in the new year. In districts where the season is not sufficiently long to grow an autumn-sown crop of red beet, a good main-crop sowing may now be made for winter use.

The beans may be used green, in the pod, or shelled, or dry; in the latter form the white, light-green, and pale-dun haricots are a popular nutritious vegetable available throughout the winter months. A light, rich, warm soil is most suitable for this crop, and where lime has been used a dressing of 1 oz. or 2 oz. of superphosphate to the square yard will be beneficial. Sow thinly so that plants stand at intervals of 3 in. or 4 in., and leave 2 ft. between the rows of dwarf varieties. Drills are made 2 in. or 3 in. deep, the latter being adopted where the land is light. The runner bean, a different botanical species to the preceding, is a perennial plant, and may be cropped for two or three years before resowing in a fresh locality.

The soil required by the gourds is very similar, rich in humus, moist, but well drained. Cucumbers may be sown to stand 12 in. to 18 in. apart and 5 ft. to 6 ft. between rows, marrows and pumpkins 3 ft. to 4 ft. between plants, with a greater distance between rows for varieties with strong runners when planted on a rich soil. Marrows are best cut green for immediate use so soon as they are of sufficient size, and the pumpkins allowed to ripen off and stored for winter use. Seed-beds of cabbage and other plants of the same family will require close attention to keep them free from insect pests. It will be the easier if remnants of older crops of the same class are cleaned up promptly so that pests are not readily carried over to succeeding crops.

So soon as danger of frost is past, kumara, or sweet-potato plants, may be set out; this will be, in many instances, early in the month of November or even later, but it should be as soon as possible, as the crop requires a long season to give best results. Meanwhile the rooted shoots are kept heeled-in closely in a sheltered bed where they are readily protected with covers in severe weather.

The soil most suitable for this crop is light, moderately rich, and clean. Where the quantity of manures or fertilizers used is small, it is generally best placed beneath the ridges on which the plants are set; larger dressings should be broadcasted and turned under. Where there is a possibility of a dry season planting is best done on the flat, otherwise a low, broad ridge will be warmest and give best results. Plants are usually set 18 in. apart and 2½ ft. to 3 ft. between rows. Planting is best done after rain, but if the weather is dry the plants should be watered in.

With rising temperatures, especially where they reach over 60° F., growers of mushroom crops are finding difficulty in controlling insect

pests. It is the greater on the older establishments, where a rigorous system of plant hygiene has not been observed, and especially when the crop is grown in sheds from which insects may not readily be excluded and where effective fumigation cannot be given. The commoner pests are mushroom-flies (*Sciara*), manure-flies (*Phoridae*), and Springtails (*Collembola*). Where the house may be closed tight these pests can be destroyed by fumigating with nicotine, a half to one fluid ounce per thousand cubic feet; otherwise nicotine sulphate, one ounce to four gallons water, may be used as a spray. In this regard it should be noted two ounces of lime hydrate should be used in the place of the usual soap ingredient, which is injurious to the mushroom crop. Another remedy is dusting with a pyrethrum powder of the highest grade. These treatments destroy the insects but not the larvæ and therefore should be repeated at intervals of two or three days, as may be necessary, to destroy the flies as they emerge.

### Small and Sundry Fruits.

Under glass the tomato crop will be setting the fruit and the success of this critical period of development depends very largely on maintaining a suitable atmosphere. Cold draughts, close humid conditions, and sudden changes are inimical. Watering when necessary should be done in the morning, excessively high or low temperatures should be anticipated and the ventilators adjusted to maintain a warm buoyant atmosphere. In warm districts a little ventilation will be required now even at night. Unless glasshouse crops can be given this close attention they are rarely profitable.

During the month of October, chiefly towards the end, the first batch of tomato-plants for outside cropping are usually planted. Set deep and firm, carefully avoiding injury to the stem, sturdy plants should do well if the land has been well prepared. Spacing, whether stakes or trellis is used, is generally 12 in. to 15 in. between plants and 3 ft. between rows.

Other half-hardy plants of this class which are planted outside at this time are passion-fruit, tree-tomatoes and Cape gooseberries, also melons and cucumber-plants which have been raised under glass. If they have been purchased or come from a distance it is as well to place them in the hardening-off frames for a while, to be sure of their condition before planting them out.

Rather more tender than the above-mentioned are peppers and egg-plants, which are planted out a fortnight or so later, when there is practically no danger of a damaging frost. With the greater interest now being taken in salads and fruit by the general public, these crops demand greater attention from commercial growers, with a rich light soil in really warm districts. The egg-plant, probably a native of India, has long been in cultivation, and has much the same cultural requirements as the tomato, except that it is more tender and requires a rather longer growing-season. For this reason they should be well advanced in growth before planting out; preferably they should be in pots so that transplanting will interfere with growth as little as possible; 2 ft. apart and 3 ft. between rows is usually suitable spacing. Peppers, or capsiums, probably originated in tropical America, and were among the many food plants introduced into Europe from that source after the great discovery. They require much the same attention as the preceding, but may be planted rather closer, the plants being set 18 in. apart with 30 in. to 3 ft. between the rows. There are a large number of varieties which may be roughly divided into those

with fruit which is "hot" or pungent as Tabasco, and Cayenne; and others which are known as "cool" or sweet, and are in demand for serving as stuffed peppers and use in salads.

Strawberries showing signs of a fair crop may now be given a dressing of nitrogenous manure with advantage just before applying the mulch. For the latter purpose clean, baled straw that has been weathered to destroy seeds is very suitable; rushes and pine-needles are sometimes used. To keep the berries free from grit thrown up by splashing rain something of this kind is usually necessary.

### The Homestead Garden.

If flowering shrubs are studied it will be noticed that they flower best either on the old wood—or the young wood, that is, one-year-old wood—or the new wood as do roses. On this chiefly the pruning treatment required depends Early-flowering shrubs of importance that carry their blossom on the young wood such as forsythias, lilacs, double-flowering peaches, Banksia rose, acacia, &c., are greatly benefited by cutting away the wood so soon as flowering is over to admit the light and air which are so necessary to the young growth that follows and is to flower next season. If favourites are given this attention their gratitude will be generously expressed by the enhanced display that will follow. Suckers also should be suppressed, as they represent so much wasted energy, and they, too, interfere in the development of legitimate growth. For this reason all rank superfluous growth inclined to crowd the plants should be suppressed. Rhododendrons rarely make sufficient growth to require much pruning, but it is well worth while removing the seed-pods from heavy-flowering varieties so soon as the petals have fallen.

As the time is arriving for setting out summer bedding-plants some preparation should be made. The fragrant stocks, the glowing zinnias, and the delicately coloured asters each have their appeal, and provide wholesome pleasure when well grown. This is best attained by strictly limiting the area planted and doing it well. The foreground of the shrubbery border so often used is rarely suitable as the interests of the respective crops often seriously clash. As the name bedding-plants indicates, they are best grown in beds or borders specially set aside for the purpose so that the proper treatment may be given. With the continuous cropping these receive there is a danger of them becoming deficient in humus, without which good results cannot be obtained. It may be supplied now by turning in a good supply of decayed farm manure. If 3 oz. or 4 oz. of bonedust to the square yard is included, success should be assured if good plants are set out in a tasteful manner. An ounce or two of superphosphate to the square yard hoed in shortly before planting would supply their more immediate need for phosphates.

Good plants are dwarf, bushy, and well rooted. It is important too they should be well hardened off and not suddenly transferred from the glasshouse or hotbed, which would cause them to become stunted in their growth. Cheap plants are very tempting, and the assurance they will make good is very plausible, but the advice previously given to limit the area and do it well is the best policy.

The "planting-season" during which hardwooded plants generally can be transplanted satisfactorily is now drawing to a close. Where new planting of this kind has been done, it will be sufficient to suppress the growth of weeds and grass in the vicinity that might rob the young plant of its requirements of light and air, and, should the season or locality be dry, a mulch of stable manure or humus about each plant will be of assistance in retaining moisture.

—*W. C. Hyde, Horticulturist, Wellington.*

# ANSWERS TO INQUIRIES.

**IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.**

## PLANTING TREES ON GORSE LAND.

B. S. H., Cambridge :—

I propose planting an area of gorse land in trees, the gorse is about 6 ft. high, but not particularly dense. Would you please advise me a simple yet efficient way to prepare this land for planting year-old trees? I presume that so long as the gorse is checked sufficiently to prevent choking out the trees, there will be no need to grub the gorse. The trees will be chiefly varieties of eucalypts.

The Fields Division :—

Eucalyptus will not smother gorse, and the most economical method would be to grub the pest before planting the trees. The eucalypt habit of growth affords ample sunlight to weed pests, consequently they thrive luxuriantly under the trees, requiring periodical cutting, &c. Should you decide to plant the trees amongst the gorse the land requires little preparation. For one-year-old trees a hole about 2 ft. square is ample. Holes should be dug well ahead of planting, so that the soil has as much weathering as possible. A dressing of blood and bone mixed with the soil at the rate of ½ lb. per tree is recommended.

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## PAMPAS GRASS.

A. V. B., Waitahora, Dannevirke :—

Will you please advise me as to the growing of pampas grass, and where seedlings may be obtained.

The Fields Division :—

Although pampas grass will establish and grow almost anywhere, like all other plants the rate of growth and vigour of the plant varies considerably with the soil and moisture conditions. Pampas grass grows best on rich, moist, drained swamp land, but will also give satisfactory growth on any medium to good farm land, particularly in damp situations, though it does not like water-logged conditions. The plant can be grown from seedlings or from rooted cuttings, from an old plant. As with marram grass, the best cuttings are taken from young two- to three-year-old plants, the side shoots being cut off below ground so that some of the roots are retained on each cutting. Seedlings were at one time supplied by Messrs. A. Yates and Co., Seed and Manure Merchants, Auckland. All plants, whether seedlings or cuttings, should be heeled in in good garden soil, and kept watered until the plants strike. It is necessary for early spring planting, therefore, to have plants on hand about May. Plants obtained in the spring should be kept in the garden and attended to until the following autumn, when they can be put out in permanent position in April or early May. The best time of planting out is in August or early September, and plants should therefore be obtained in the previous autumn. In heeling in or planting out the earth should be packed tightly round the roots and the soil kept moist and loose at the surface, though very firm below. For shelter or fodder pampas is planted in rows 6 ft. apart with 6 ft. between the rows, 1,000 plants being required per acre. It must be well protected from cattle, as continuous grazing will kill even fully grown plants. A certain amount of light cultivation round the plants during establishment and a light dressing of super annually will do much to push the growth forward when once full grown and fit to feed off, which may take anything from two to four–five years, according to soil conditions, &c. The grazing-off of the plants will be followed by a rapid growth sufficient in most cases to give about the same amount of leafage as was on the plants when first fed off. After feeding off, say, in the winter, it is necessary, therefore, to close the area immediately until the following winter. It is best also to feed off if possible in breaks, rather than as a whole. An established and well-grown area of pampas grass would provide a permanent winter-feed reserve for cattle, and could be made of particular value to the sheep-farmer who requires to winter cattle for feed-control purposes in the spring and summer. Pampas grass is also a valuable fodder for wintering dry cows on the dairy-farm.

# WEATHER RECORDS: AUGUST, 1937.

Dominion Meteorological Office.

## NOTES FOR AUGUST.

AUGUST is normally regarded as the last month of winter, but that just past was mild, pleasant, and distinctly spring-like in character. The cold of the early winter caused a shortage of pasture in many districts during the first part of the month, and it was necessary to resort to hand-feeding of stock. The dry weather accentuated this condition. In addition to pastures, the wheat crops in mid-Canterbury and North Otago suffered considerably, and mild rains are badly wanted there and at some other localities. Over most of the country, however, there was fairly rapid growth of vegetation during the latter half of the month, and stock have kept in fair condition. The weather was favourable for lambing, and the losses have been relatively light.

*Rainfall.*—The month was a particularly dry one over most of the Dominion The greatest defects from normal rainfall occurred in the southern half of the North Island and the eastern area of the South In some places it was the driest August ever experienced. In parts of eastern North Auckland, in the Bay of Plenty, and in the Gisborne area, however, the average was exceeded.

*Temperature.*—At a few places in North Auckland and in Hawke's Bay the mean temperature was slightly below normal, but over the remainder of the country the normal was exceeded. The departure was in the vicinity of 0°·5 in the North Island, but greater in the South, and at places in the western and far southern districts it exceeded 2°.

*Sunshine.*—There was a prevalence of cloudy weather, and the amount of bright sunshine recorded fell below the average for August, the deficiency being greatest in the eastern districts of the South Island.

*Pressure Systems.*—One storm system alone during the month caused generally disturbed conditions. This was a deep depression of the westerly type which passed between the 3rd and the 7th. Strong winds and fairly general rains occurred during this period, the worst effects being experienced on the night of the 6th and on the 7th, when a severe south-westerly gale blew in most districts, with hail and snow in places. By the 8th the front of an anticyclone had extended on to the Dominion, and from then until the 26th pressure remained high.

An intense cyclonic depression, which was located off the New South Wales coast on the 21st, moved very slowly across the Tasman Sea during the next few days, and from the 23rd to the 27th was responsible for north-east winds and mild, dull, misty weather in the Dominion, with scattered rains. The latter were mostly light, but some heavy falls occurred at places in North Auckland and on the east coast of the North Island. By the 27th, when it had at last crossed the Dominion, the cyclone had become a very shallow one, and the southerly which was associated with its rear was very mild.

Anticyclonic conditions and fine weather again ruled on the 28th and 29th, but on the latter day a fresh cyclonic depression formed to the north-west of New Zealand. This moved slowly, at first, in a south-easterly and later in an easterly direction, passing Cape Maria van Diemen to the northward on the 30th Dull and misty weather prevailed over most of the country. Gales from between east and south-east blew in the northern and eastern portions of the North Island on the 30th and 31st, accompanied in many places by heavy rain. In the Bay of Plenty some flooding occurred.

RAINFALLS FOR AUGUST, 1937, AT REPRESENTATIVE STATIONS.

| Station. | Total Fall. | Number of Wet Days. | Maximum Fall. | Average August Fall. | Total Rainfall to Date. | Average Rainfall to Date. |
|---|---|---|---|---|---|---|
| *North Island.* | | | | | | |
| Kaitaia .. .. | 2·48 | 10 | 0·78 | 5·12 | 44·34 | 38·76 |
| Russell .. .. | 13·97 | 15 | 5·85 | 5·52 | 82·25 | 42·86 |
| Whangarei .. .. | 9·39 | 20 | 3·42 | 6·31 | 66·77 | 45·10 |
| Auckland .. .. | 1·53 | 13 | 0·40 | 4·61 | 31·75 | 34·47 |
| Hamilton .. .. | 2·03 | 8 | 1·25 | 4·11 | 28·36 | 33·11 |
| Rotorua .. .. | 2·14 | 5 | 1·03 | 4·91 | 33·02 | 36·76 |
| Kawhia .. .. | 1·08 | 6 | 0·40 | 4·63 | 25·10 | 36·18 |
| New Plymouth .. | 1·54 | 7 | 0·65 | 5·49 | 40·13 | 40·41 |
| Riversdale, Inglewood .. | 2·52 | 9 | 1·17 | 8·89 | 63·07 | 67·60 |
| Whangamomona .. | 0·47 | 3 | 0·24 | 6·02 | 46·16 | 48·99 |
| Hawera .. .. | 0·87 | 7 | 0·23 | 4·50 | 27·49 | 30·11 |
| Tairua .. .. | 3·06 | 13 | 1·13 | 5·84 | 40·54 | 45·71 |
| Tauranga .. .. | 4·66 | 11 | 2·88 | 4·30 | 38·34 | 36·12 |
| Maraehako Station, Opotiki | 3·49 | 8 | 1·58 | 5·48 | 43·51 | 37·73 |
| Gisborne .. .. | 6·92 | 14 | 2·24 | 4·33 | 29·66 | 34·29 |
| Taupo .. .. | 0·99 | 6 | 0·57 | 4·07 | 21·59 | 29·30 |
| Napier .. .. | 1·98 | 10 | 0·95 | 2·95 | 16·82 | 22·30 |
| Hastings .. .. | 2·25 | 10 | 1·06 | 3·15 | 13·69 | 23·42 |
| Taihape .. .. | 0·57 | 8 | 0·36 | 2·74 | 20·59 | 23·52 |
| Masterton .. .. | 1·75 | 13 | 0·55 | 3·59 | 22·81 | 26·54 |
| Patea .. .. | 0·85 | 7 | 0·28 | 3·81 | 28·01 | 29·44 |
| Wanganui .. .. | 0·82 | 6 | 0·32 | 2·81 | 21·13 | 23·85 |
| Foxton .. .. | 1·42 | 4 | 0·77 | 2·95 | 15·32 | 21·33 |
| Wellington .. .. | 1·03 | 8 | 0·31 | 3·93 | 23·62 | 29·67 |
| *South Island.* | | | | | | |
| Westport .. .. | 3·00 | 7 | 1·29 | 7·70 | 53·64 | 62·50 |
| Greymouth .. .. | 2·39 | 14 | 0·70 | 7·48 | 66·72 | 64·97 |
| Hokitika .. .. | 5·29 | 12 | 1·21 | 9·24 | 72·19 | 73·29 |
| Ross .. .. | 8·36 | 12 | 2·20 | 10·43 | 85·65 | 82·38 |
| Arthur's Pass .. | 2·96 | 8 | 0·84 | 10·20 | 92·14 | 96·07 |
| Okuru, South Westland | 7·82 | 6 | 2·24 | 11·24 | 99·12 | 93·80 |
| Collingwood .. .. | 2·36 | 5 | 0·98 | 7·11 | 56·18 | 62·09 |
| Nelson .. .. | 1·89 | 7 | 0·76 | 3·06 | 23·90 | 24·86 |
| Spring Creek, Blenheim | 1·58 | 8 | 0·75 | 2·75 | 17·53 | 20·64 |
| Seddon .. .. | 2·40 | 9 | 1·43 | 1·90 | 16·42 | 16·62 |
| Hanmer Springs .. | 1·00 | 8 | 0·26 | 3·42 | 21·32 | 29·48 |
| Highfield, Waiau .. | 1·10 | 5 | 0·75 | 2·45 | 14·57 | 22·53 |
| Gore Bay .. .. | 2·02 | 6 | 1·30 | 2·64 | 22·28 | 21·31 |
| Christchurch .. .. | 1·76 | 11 | 0·83 | 1·82 | 16·47 | 16·99 |
| Timaru .. .. | 1·01 | 8 | 0·57 | 1·45 | 14·61 | 14·43 |
| Lambrook Station, Fairlie | 0·51 | 5 | 0·20 | 1·53 | 12·81 | 16·13 |
| Benmore Station, Clearburn | 0·97 | 7 | 0·27 | 1·48 | 18·57 | 16·02 |
| Oamaru .. .. | 0·76 | 9 | 0·15 | 1·74 | 11·25 | 14·44 |
| Queenstown .. .. | 1·05 | 6 | 0·62 | 2·05 | 19·72 | 19·43 |
| Clyde .. .. | 0·76 | 4 | 0·35 | 0·79 | 11·13 | 9·45 |
| Dunedin .. .. | 1·90 | 14 | 0·63 | 3·07 | 30·06 | 24·13 |
| Wendon .. .. | 1·77 | 10 | 0·40 | 2·05 | 31·11 | 19·27 |
| Balclutha .. .. | 1·33 | 10 | 0·36 | 1·78 | 24·51 | 16·27 |
| Invercargill .. .. | 1·99 | 17 | 0·44 | 3·20 | 30·30 | 29·78 |
| Puysegur Point .. | 5·16 | 21 | 1·28 | 6·94 | 61·39 | 55·35 |
| Half-moon Bay .. | 2·15 | 15 | 0·57 | 4·39 | 42·18 | 37·92 |

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## RECLAIMED TIDAL LAND AT PIPIROA.

### THE VALUE OF STRAWBERRY-CLOVER.

By J. E. BELL, Instructor in Agriculture, Auckland.

THE littoral clay soils of the Hauraki Plains dry out quickly in dry weather. At Pipiroa there are about 800 acres of reclaimed land which have been stopbanked from sea and river and drained. This area is roughly triangular in shape and is bounded on the north by the sea-coast and on the east by the Piako River. The soil is a stiff clay. The drains, which were dug, proved reasonably effective, and after the land became sufficiently free of salt the area was sown in pasture. This soon grew luxuriantly, and the resultant sole of rye-grass and white clover supported highly productive dairy herds, and was famed on the Hauraki Plains for its health-giving and fattening properties. After a few years of dairying, and probably as the result of winter trampling and puddling of the soil entailed by dairying, the drainage system became less efficient. About fifteen years ago deterioration of the pastures was first noticed, and culminated in the dry summer of 1928–29 in the disappearance of almost all the pasture-plants on the reclaimed land and also on other patches, on clay soils in the vicinity of Pipiroa, and also on isolated areas as far inland as Ngatea. The depleted areas comprised, in all, about 1,000 acres of land. The worst damage was apparent in the reclaimed triangular area at Pipiroa, which was almost bare of vegetation. At the margins of this area and on the other areas almost all the grass was dead, but the dead stalks of grass were still to be seen. Throughout the depleted areas there were still alive a few patches of *Poa pratensis* and prairie-grass, and odd plants of tall fescue and meadow-foxtail. These grasses did not appear to suffer much.

One piece of ground at Pipiroa was conspicuous for its distinctive green colour—a patch of strawberry-clover (*Trifolium fragiferum*) a few square yards in extent in one of the fields on Mr. J. Mangan's property. This patch, no doubt the result of the establishment of one seedling, was to play, and continues to play, an important part in the rehabilitation of the area at Pipiroa, but its virtues were not fully realized till later. What had occurred was the destruction of the rye-grass and white clover, which held so dominant a position in the pastures that their disappearance left a desolate desert.

FIG. 1.—THE DEPLETED LAND AT PIPIROA: BARE GROUND, BUTTERCUP, DOCKS.

FIG. 2.—A PASTURE OF REVERSED CLOVER AND POA ANNUA, WITH ODD PLANTS OF BUTTERCUP, LOTUS, AND RYE-GRASS.

### SETTLERS IN SORRY PLIGHT.

The settlers were in a sorry plight, and, as a result of their complaints, the country was examined by officers of the Department of Agriculture. The bare soil had cracked very badly, and these cracks formed ideal homes for crickets, which were present in their millions. They would hop and flutter in dozens at each step of the visitor as he walked across the fields. They nibbled the remaining pasture and anything lying about that was eatable, and were even known to devour clothes and to fight and eat each other. A caterpillar of the *Porina subterranea* species was also present on the marginal land, where the grass was dying and where the ground was still covered by dead stalks of rye-grass.

Various opinions were expressed by farmers and others as to the cause of the depletion. Many farmers blamed the crickets, and said that they were the sole cause of the trouble, while others were as emphatically of the opinion that the crickets were not entirely to blame. The presence of the *Porina* led a few to believe that this caterpillar, after destroying the rye-grass, had disappeared from the bare areas and was working its way along the marginal land and in freshly attacked patches, making further inroads into the untouched grassland. Others believed that the trouble was caused by the surface layers of the soil becoming poisoned by salt deposited there, as the soil moisture, with the salt in solution, rose by capillarity and evaporated at the ground surface. This trouble would be prominent in dry summers, yet there was no visible sign of alkali on the ground surface. Another theory was that, as the area was not well drained, the puddling of the area by dairy cows each winter had resulted in an alteration of the physical nature of the clay, so that it cracked and dried out so badly in the summer that the rye-grass died.

Investigations were started in 1929–30, the season following the year of marked deterioration. An area was sown down in various mixtures of grasses with a basal clover mixture of white clover, strawberry-clover and *Lotus major*. The area was manured with ammoniated super. Later it was realized that this manurial dressing was unsuitable for sowing down, due to its inimical effect on clover establishment. Certainly the pasture had to struggle to live, and in the early periods the death of the grasses was feared. Fortunately the 1929–30 summer was a wet one, the following five seasons were not dry ones, and gradually the pastures on the trial area improved and finally became fairly well established. The following grasses were tried: perennial rye, Italian rye, meadow-fescue, *Paspalum dilitatum*, cocksfoot, crested dogstail, meadow-foxtail, *Poa trivialis*, timothy, and *Phalaris bulbosa*. Different chemical treatments were tried, including super, slag, carbonate of lime, gypsum, 30 per cent. potash salts, sulphate of ammonia, sulphur, nitrochalk, and manganese sulphate.

### SEASONAL CHANGES.

In the meantime parts of the depleted area showed amazing changes at every season of the year. The bare ground became colonized chiefly by buttercup, dock, pennyroyal, and sowthistle (all high-fertility-demanding weeds), and by *Poa annua*, goose-grass, reversed clover (*Trifolium resupinatum*), and *Lotus major* and *Lotus hispidus*. Favoured well-stocked areas such as night paddocks contained much reversed

FIG. 3.—TWO PLANTS OF REVERSED CLOVER, SHOWING HABIT OF GROWTH AND THE TYPICAL SEED-HEAD.

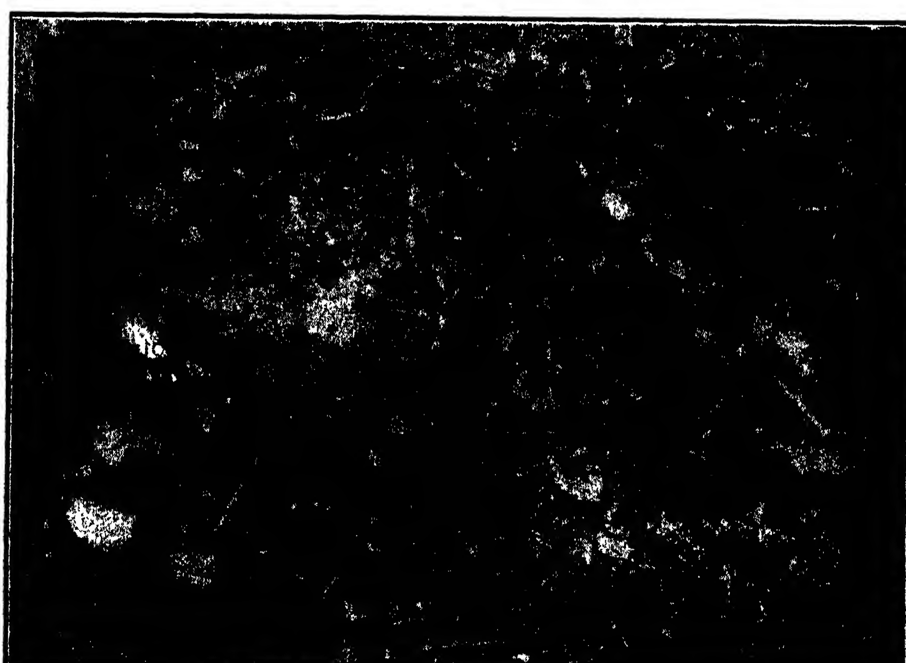

FIG. 4.—STRAWBERRY-CLOVER STOLONS INVADING DEPLETED LAND, WHICH WAS MAINLY BARE GROUND, WITH ODD PLANTS OF BUTTERCUP, SCOTCH THISTLE, AND LOTUS.

clover and *Poa annua*, and a little perennial rye, while less favoured areas were only sparsely colonized by *Lotus major* and weeds. If two consecutive wet summers were experienced, white clover and volunteer rye-grass would reappear in some of the fields, and these for a time would be quite highly productive. Under clumps of trees, particularly around homesteads, where excessive grazing was not allowed, and where the tree-roots prevented undue trampling by stock, patches of prairie-grass, thriving very well indeed, could be seen. One or two attempts were made to establish prairie-grass in the open fields, but it did not prove to be of high production under such conditions. On one of the night paddocks meadow-foxtail was present to a fair extent. On some hayfields there would be much goose-grass, a pasture-plant of low production. There was also one patch of *Agropyron repens* permanently established. The dry-soil condition in the summer was suitable to this grass, which, however, was in a rather sodbound condition, with no clover present in its midst. In consequence its production was only fair, and it was neglected by stock. All these different types of pasture, although welcome because they provided some feed, were viewed as unsatisfactory by the settlers, who had been accustomed to, and expected to see, permanent high-class swards of rye-grass and white clover.

Most of the farmers adopted the policy of *laissez-faire*, which perhaps was the most sensible one to adopt. Some attempted to grow crops of maize, barley, soft turnips, and other supplementary crops for their cows. These were grown with difficulty, as the soil was wet and heavy and difficult to cultivate, and once cultivated was very soft in the winter. Of the crops, maize gave the best results, and barley was quite successfully grown. Small patches of lucerne were grown with slight success by one or two farmers, but the ground was too wet for the production of good crops.

## Heavy Crops of Hay.

In autumns following dry summers the annuals and some perennials would establish themselves from seed and would form root systems throughout the winter months, but during this period of establishment the production of leafage was poor. *Poa annua* gave most of the fodder, and, though of slow growth, produced highly palatable and nutritious feed, and proved a very useful volunteer. The reversed clover produced very little feed in the winter, but in the spring fields colonized by it grew an enormous amount of highly nutritious fodder. Extremely heavy crops of hay, of up to 3 tons per acre, were secured from this clover, the growth of which in favourable seasons suppressed almost all other plants in the sward. Reversed clover has a leaf very similar to white clover in appearance, being hairless and of as fine a texture. It forms small rosettes in the winter and early spring about 6 in. in diameter. In the spring it sends up tall upright stems about 3 ft. long (some specimens have been reported to be 5 ft. long). These stems are slender (much finer than lucerne), and hay crops usually lodge and are difficult to cut. The flower-head is small and contains about twenty-five florets like white clover florets, only they are of a light purple colour. Each floret develops a single seed, which becomes

FIG. 5.—STRAWBERRY-CLOVER INVADING IN MASS FORMATION PRACTICALLY BARE GROUND.

Notice the dead stalks of pennyroyal on the uninvaded territory.

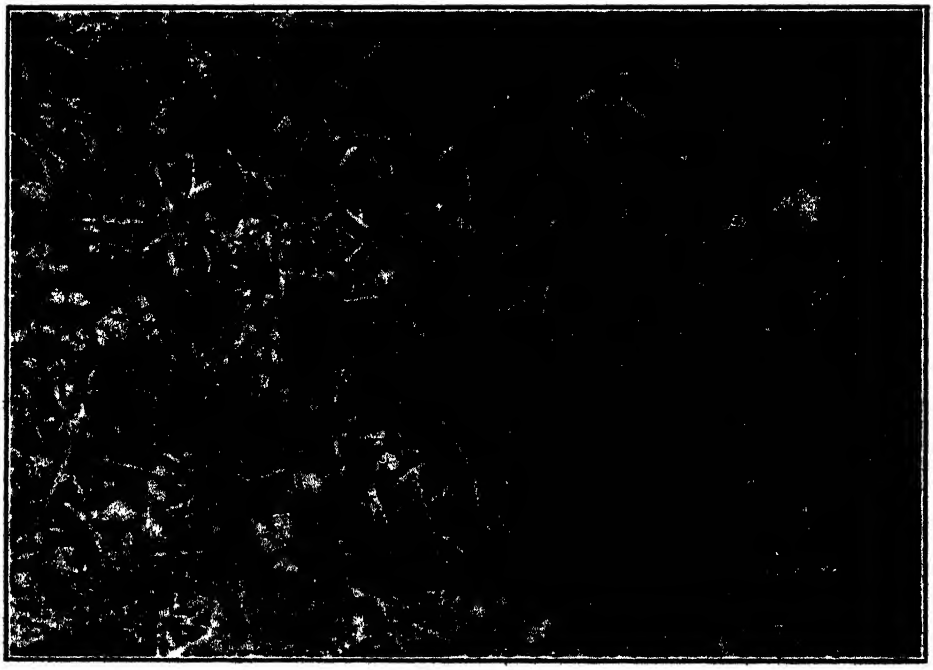

FIG. 6.—STRAWBERRY-CLOVER WELL ESTABLISHED ON DEPLETED LAND.

enveloped in a veined diaphanous capsule. When the capsule has enveloped the seed the seed-head has a strawberry-like appearance, and is about ⅜ in. in diameter, much larger than the flower-head.

By Christmas both the *Poa annua* and the reversed clover would be dead, and in the dry Januaries and Februaries usually experienced practically no vegetation would be produced. In wet summers there would be some white clover and *Lotus major* growth. Thus as the seasons varied and the management changed on the different fields, so the sward would alter with lightning rapidity (or so it would appear to the periodic visitor). One wet summer encouragement would be given to the presence of white clover and some rye-grass on favoured areas. Next spring there would be the usual thick tangled mass of reversed clover, then a dry summer and a hopeless looking bareness. Always a fight was going on between annuals and perennials. Wet summers favoured the survival of perennials, and thicker swards of these in the autumn meant less and weaker annuals and a poorer showing of them in the spring. Dry summers meant death to perennials and a bare soil for the seedling of many annuals, which were then not hampered by perennials in their establishment in the winter, and grew vigorously. The weakness of a pasture populated chiefly by annuals was very evident, the production from January to September being very low. In spite of the very high production during the remainder of the year by reversed clover, the butterfat-production was only a fraction of that when the area was carrying a sole of perennial rye-grass and white clover. A pasture of this kind would not perhaps be quite as high-yielding in the spring, but its production during the rest of the year would eclipse that of the annuals now growing in its place. Most of the area was not evenly thickly populated by annuals, and the production was low in the extreme.

## Manurial Experiments.

The manurial experiments were of little value, for most of the treatments made no impression, and the others had little noticeable effect. The most promising of the treatments were super, slag, and potash. The only grass that proved of value in the trials was perennial rye-grass, and this established itself only where there was a good sole of volunteer reversed clover or strawberry-clover. The rye-grass was most vigorous and plentiful where strawberry-clover was well established. All other grasses except *Phalaris bulbosa* and paspalum made a showing. *Phalaris bulbosa* has become aggressive, and not being liked by stock is proving a nuisance. The paspalum threw very little feed.

## Strawberry-clover Established.

In the 1934–35 season there was another dry summer almost as arid as the summer of 1928–29, and, with the exception of a few patches, the pastures once more disappeared on the deteriorated areas. These patches when examined proved to be areas where strawberry-clover had established itself. Some of the settlers had suspected by now that the cure of the trouble was strawberry-clover establishment. One or two had commenced to sow and plant it in their fields, and the one patch which had demonstrated its value in 1928 had now spread, chiefly by natural means, over several fields.

FIG. 7.—THE FINAL STAGES—A STRONG PASTURE OF RYE-GRASS AND STRAWBERRY-CLOVER, WITH WEEDS AND ANNUAL AND INFERIOR PASTURE-PLANTS ELIMINATED

FIG. 8.—A SIDE VIEW OF TURF NO. 7 (RYE-GRASS – STRAWBERRY-CLOVER PASTURE). Note the strong root-growth of strawberry-clover showing at the side of the turf.

Strawberry-clover is a perennial plant, is like white clover in its habit of growth, spreading over the ground by means of stolons. Like white clover also it is a twitch, and the stolons strike roots at the nodes. But, unlike white clover, it is very deep-rooting and its roots will penetrate over 20 in. into the soil. This deep-rooting habit explains its successful growth on dry or salty soils and its high summer production. The leaflets of strawberry-clover are hairless and similar in appearance to those of white clover. A distinguishing feature, however, is that they are generally long and narrow compared with white clover leaflets. The flower is very similar to the white clover flower, but the petals usually have a pinkish tinge. Later it forms the strawberry-like seed-head from which it receives its name. The seed-head is similar to the reversed clover seed-head just described.

Strawberry-clover establishes itself best in damp situations, whether from seed or transplanting. When established it grows best where the drainage is good. It will exist in drier or more salty and in wetter conditions than white clover. It demands high fertility—probably higher fertility than even white clover for vigorous growth. In the winter and in wet summers it grows less vigorously than white clover. In dry summers, however, it excels.

Strawberry-clover can be seen at Pipiroa invading territory but sparsely populated by weeds and annuals. It is a better colonizer than reversed clover, and is occupying fields poorly favoured by stocking in which reversed clover has not established, although given every opportunity to do so. The strawberry-clover at Pipiroa suffers in that it is a shy seeder. It is essentially a leaf-producer. If it was as prolific a seeder as reversed clover, there would be no depleted land now at Pipiroa. After strawberry-clover has established itself, perennial rye-grass commences to grow in its midst, and the pasture becomes a rye-grass - strawberry-clover one. Such a pasture is capable of high butterfat-production per acre, comparable to rye-grass and white clover. The rye-grass produces most of the feed in the autumn, winter, and spring, and the strawberry-clover in the summer. Strawberry-clover being a permanent clover of high production, and providing a dense cover of the ground, is similar in habit to white clover. At Pipiroa it is successfully taking the latter's place.

## Cause of Deteriorated Pastures.

By now it was fully realized that the deterioration of the pastures was caused by the death of white clover. White clover holds a key position in our high-class pastures, and if it fails the pasture-grasses suffer. A sequence of events may follow the failure of white clover such as befell the pastures at Pipiroa, leading to almost complete destruction of the sward. One is tempted to portray the probable sequence at Pipiroa because it is interesting and may serve as a basis to work on where other instances of depletion are met.

Either the soil became too salty or too dry for white clover to live. Excess of salt in the soil kills a plant by depriving it of water, and so the effect is the same as lack of moisture in the soil. White clover is perhaps the most shallow-rooted of our pasture-plants and very susceptible

to dry conditions. The summer of 1928–29 being very dry, the heavy Pipiroa soil dried out to a very great extent and the white clover died out completely. The death of white clover of course left the ground more open to the action of the sun's rays and still further drying-out resulted. The rye-grass would be now in a very weak state or dead. The *Porina* caterpillar, being more common in dry climates and in sparse pastures, was apparently encouraged by the suitable conditions prevailing on the weakened pastures, and completed the destruction of the rye-grass. With no vegetation to keep the surface moist, and no

FIG. 9.—A PLANT OF STRAWBERRY-CLOVER (RIGHT) AND A PLANT OF WHITE CLOVER (LEFT) FOR COMPARISON.

Note the length of the root of the strawberry-clover and the short roots of white clover, from the stolon.

live roots to hold the soil together, the ground cracked, making homes for millions of crickets, which cleared up the dead stalks of rye-grass. The result was that on 1,000 acres of land, on which all the rye-grass and white clover was destroyed, all that was left were odd plants of tall fescue, weeds, and patches of *Poa pratensis*, prairie-grass in one or two places, and one small green patch of strawberry-clover. The *Porina* caterpillar was working at the edges of the depleted land now swarming with crickets. Investigators were called in at this stage, and their confusion is perhaps understandable. If they had been able to see the progressive deterioration their job would have been a much easier one.

This patch of strawberry-clover finally showed that what was lacking was a thick permanent sole of clover. Conditions were too dry in many seasons in the summer for white clover, but they were not too dry or too salty for strawberry-clover. Strawberry-clover well established, and the permanent rye-grass soon appears. A thick sole of rye-grass and strawberry-clover, and there is no infestation of *Porina* caterpillar, no cracking of the soil and a home for crickets. Thus what appeared a complex problem is solved.

### Success in Transplanting.

The strawberry-clover is extending its range steadily. During the past eight or nine years it has covered about 20 acres of land, mainly by natural means. Every endeavour now should be made to establish this plant all over the remaining 900-odd acres to make it again highly productive. One farmer at Pipiroa, Mr. Scott, has been establishing strawberry-clover by transplanting it in his fields for the past three years. The earliest planted area has now patches of this clover up to half a square chain in extent. At first he took great care in transplanting, and obtained fairly large sods for transplanting. Lately very small sods the size of the palm of one's hand are transplanted successfully. Another farmer has obtained successful establishment with cuttings of stolons placed on the ground when it is moist and simply trodden into the soft earth or mud. The transplanted material establishes itself best in hollows, or in old watercourses where the soil is moist in the summer. During the first year the transplanted strawberry-clover does not spread rapidly, and colonizes in that period about a square yard. After the first year its spread is increasingly more rapid, and it consolidates its position by thickening.

The other method of strawberry-clover establishment is by seeding. Unfortunately the type of this clover frequently obtained from purchased seed is not virile, and although useful, does not compare with the type of strawberry-clover already established at Pipiroa. The seed is also expensive. The clover establishes itself best in hollows or plough finishes, where the soil is moist over the summer. Apparently strawberry-clover before its deep-rooting system develops is less tolerant of dry conditions. Yet when established, in the winter where the soil is poorly drained and wet, strawberry-clover appears unthrifty, and, as previously mentioned, it excels in dry summers.

Before establishment by seed will be advisable some research will have to be made on the productivity of strains of strawberry-clover. There is no doubt that different strains exist, and will be found to vary in yield as markedly as different strains of white clover.

There are thousands of acres of reclaimable marine flats in and around the harbours of North Auckland which are being gradually reclaimed and grassed. For the future safety and well-being of these areas, strawberry-clover should be included in the grass and clover sowings. I hope that, before many of these areas are reclaimed for grassing, investigation will have revealed areas of leafy high-yielding strawberry-clover from which supplies of seed can be obtained.

# VERNALIZATION TRIALS WITH WHEAT.

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VERNALIZATION, devised by T. D. Lysenko (1) at the Odessa Institute of Plant Breeding, is a method involving the pre-treatment of seed to accelerate its development and induce earlier maturity. The subject has received much prominence of recent years. Writing of this method N. A. Maximov (2) says, "The extreme simplicity and yet high efficiency of this method has been demonstrated by the fact that during the current year, 1934, about one million hectares (approximately 2,500,000 acres) have been sown with vernalized seed in U.S.S.R., and yet reports of failure in carrying out vernalization are very rare, even in localities most remote from scientific centres." While reports generally from the U.S.S.R. comment favourably on the method, reports from other centres are more conflicting, varying from records of complete success to failure (3).

The technique for wheat suggested by Lysenko is briefly as follows (1): The seed is moistened with one-third of its weight of water, the water being added in several applications until all has been absorbed. The moistened grain is then spread in layers of from 9 in. to 12 in. deep and allowed to germinate. During this process the temperature should not be greater than 15° C. If it rises, the grain must be spread more thinly, and *vice versa*. When in odd grains the embryo has pierced the seed-coat the temperature is reduced to 3° to 5° C. and held at that for the required length of time. This is given as varying from twelve to fifty days according to the variety. When sowing through a drill, the seeding-rate has to be adjusted to allow for the swollen nature of the grain.

Two possible applications of the practice suggested themselves for New Zealand conditions. On certain of the heavy wheat lands, typically winter wheat country, autumn rains often so delay cultivation that autumn sowing becomes impossible. If by vernalization the growth of a winter variety could be so accelerated to allow of its being spring-sown, this difficulty would no longer exist. In other districts spring sowing following turnips is a regular practice, but often proves disappointing owing to the lateness of sowing. Hastening the maturity by vernalization suggested a method whereby this practice might be rendered more certain.

To test out these possibilities under local conditions experiments with wheat were planned and carried out at the Agronomy Division, Lincoln, during the past season. Four varieties, giving a wide range of maturity were chosen—Hunters and Velvet, both winter wheats; Jumbuck, a spring wheat; and Solid Straw Tuscan, a variety which can be sown with success in either autumn or spring. Lysenko's technique as described above was followed. The moistened grain was germinated in shallow trays and then placed in a refrigerator at 3° to 5° C. for periods of eleven, eighteen, and twenty-five days. These were so timed that all the seed was ready for sowing on the same day. Sowing took place on 7th October. Each treatment was repeated five times for each variety, and untreated controls were included in all plots. There were no significant differences in

germination between the treatments or between the treatments and the controls. In all cases, however, the untreated seed was a day later in coming through the ground.

The relative maturity of the treatments, as indicated by heading dates, is given in Tables I and II for spring and winter wheats respectively.

*Table I.—Spring Wheats.*

| — | Jumbuck. | | Solid-straw Tuscan | |
|---|---|---|---|---|
| | Date Headed. | Days Earlier than Control | Date Headed. | Days Earlier than Control. |
| Control unvernalized .. | 27th Dec | .. | 7th Jan | .. |
| Eleven days vernalization .. | 25th Dec | 2 | 5th Jan. | 2 |
| Eighteen days vernalization .. | 23rd Dec | 4 | 5th Jan. | 3 |
| Twenty-five days vernalization | 23rd Dec. | 4 | 4th Jan. | 3 |

From the above table it will be seen that both varieties showed a slight acceleration in heading. Threshing-weights revealed no differences as the result of any of the treatments. Grain samples from each of the treatments were similar, those of Jumbuck being very well developed, while those of Solid-straw Tuscan were slightly pinched.

*Table II.—Winter Wheats.*

In the winter wheats Velvet and Hunters retained their winter habit into February. A count was made on 12th February, when earing was as follows :—

| — | Velvet. | Hunters. |
|---|---|---|
| | Per Cent. | Per Cent. |
| Control unvernalized .. .. .. | .. | 2·4 |
| Eleven days vernalization .. .. | 4·8 | 5·9 |
| Eighteen days vernalization .. .. | 8·8 | 11·2 |
| Twenty-five days vernalization .. .. | 14·7 | 18·1 |

These ears set grain, which, when the experiment was finally examined on 8th March, was in the milky stage.

Further ears continued to appear. These late ears were small and short and mostly empty, although some contained very immature grain. A final count of the total plants in ear was made on 8th March. These figures are given in the following table :—

*Table III.*

| — | Velvet. | | | Hunters. | | |
|---|---|---|---|---|---|---|
| | In Ear. | Shot Blade. | Winter Habit. | In Ear | Shot Blade. | Winter Habit. |
| | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. |
| Control unvernalized .. | 4·0 | 61·4 | 34·6 | 13·6 | 86·4 | .. |
| Eleven days vernalization .. | 13·9 | 75·5 | 10·6 | 26·5 | 73·5 | .. |
| Eighteen days vernalization .. | 25·3 | 68·1 | 6·6 | 39·5 | 60·5 | .. |
| Twenty-five days vernalization | 33·9 | 61·0 | 5·1 | 51·2 | 48·8 | .. |

SUMMARY.

(1) Vernalization accelerated the earing of spring wheats such as Jumbuck and Solid-straw Tuscan, but the degree of acceleration was slight and insufficient to be of any practical significance under New Zealand conditions.

(2) When winter wheats such as Hunters and Velvet were vernalized and spring sown, the treatment induced a very much higher proportion of ears to develop, but in no case did they reach maturity. Even so, earing was forty-seven days later than untreated Jumbuck.

(3) The percentage of earing progressed with increased lengths of treatment, and it is probable that an even longer period would still further accelerate development.

(4) From these trials vernalization does not appear to have any place in commercial wheatgrowing in New Zealand. Satisfactory spring varieties are already in existence, and in any case the long period of treatment that is necessary would render the practice uneconomical.


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# NEW TREE FOR FARM SHELTER.

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IT is generally admitted that the most useful and desirable type of medium-high shelter is that obtained by growing a combination of rows of *Pinus radiata* and *Cupressus lawsoniana*. Usually two to four rows of pines are planted, with the trees 6 ft. to 8 ft. apart each way, and with one row of *Cupressus lawsoniana* (or *Cupressus Benthamii*) planted 12 ft. to 15 ft. from the pines, with the *Cupressus* trees 4 ft. to 6 ft. apart within the row.

The value of this combination of trees is that the pines are able to provide the high shelter and the lower-growing *lawsonianas* form a dense low line which overcomes the ill effects of the openness between the trunks of the mature pines. Winds which rush through the bare trunks of pines which have lost the lower branches or which have no dense low shelter on one side are probably as severe as where there is no tree-shelter whatever. For low shelter in odd corners or along part of one side of a field *lawsonianas* alone may well be grown in double rows. Such shelter-belts are a feature of many parts of Waikato and are a tremendous asset to those who have been successful in establishing this combination of pines and *lawsonianas* or *lawsonianas* alone.

Throughout the South Island reports are received that it has been impossible to establish belts of *Cupressus lawsoniana*, except on the very best land in the warmer localities of a few districts. To get them to grow at all on the Plains areas one has at least to dig holes and fill these with good soil, in which the *lawsonianas* can then be planted. Even then these trees do not grow well as they approach maturity.

A SPECIMEN OF CUPRESSUS ARIZONICA GROWING AT CANBERRA. IT IS TWENTY YEARS OLD AND ABOUT 25 FT. HIGH, GROWING UNDER CONDITIONS OF A 20 IN. RAINFALL.

All over the Canterbury Plains one can find lines of various species of pines which are quite open at the ground and which thus fail to provide effective stock-shelter. The problem is to find a tree which will grow in association with pines and provide ground shelter in the same manner as *Cupressus lawsoniana* does in Waikato, Taranaki, and Manawatu. *Cupressus macrocarpa* has been recommended for this purpose, but the results, particularly on the drier areas, have not been promising. The branches of *Macrocarpa* grow upright, and unless a trimmed hedge is maintained this tree fails to provide the low shelter.

At Canterbury Agricultural College Professor E. R. Hudson has introduced a new species of cypress which is likely to fulfil the requirements of South Island dry conditions. This valuable addition to our farm-shelter trees is *Cupressus arizonica*, the Arizonian Cypress, the seed of which has been introduced from Canberra.

### THE FEATURES OF CUPRESSUS ARIZONICA.

The following is an extract from a letter received from Mr. A. E. Bruce, Superintendent, Parks and Gardens Section, Department of the Interior, Canberra:—

"With regard to the qualities of *Cupressus arizonica* as a farm shelter-tree, I should say they were perfect. Its hardiness is unequalled in heat or cold, in dry or wet. There is no other species of Cypress which surpasses it in these respects. Its soil requirements are very easily satisfied, provided good preparation is given to the ground and the position in which it is to be planted. It will withstand any amount of trimming back. We have miles of it used as hedges, kept at a height of 2 ft. 6 in. by 1 ft. 6 in. to 2 ft. wide. The economic value of the tree I cannot comment upon, beyond the fact that its growth here is nearly equal to that of *Pinus radiata*, and I feel sure that the timber is much better in quality than that of *Pinus radiata*—close-grained and very tough. I am of the opinion that you cannot go wrong with *Arizonica* as a shelter-tree, and I believe its growth would be much better with you than with us in our area of 21 in. rainfall."

In the *Agricultural Gazette* of New South Wales, January, 1930, there is the following comment on *Cupressus arizonica*:—

"This species has not been grown to any great extent in this State, but is one of the most widely planted of the Cypresses in South Africa—used for hedges, breaks, and shelter-trees. It does well on a wide range of soils. The lateral branches have a fairly wide spread and provide excellent shelter, a single row being very effective as a windbreak."

It is believed that this tree will prove most useful under South Island conditions. It is certainly worthy of extensive planting under the conditions in which *Lawsoniana* and *Macrocarpa* have failed.

The accompanying photograph of a twenty-year-old specimen of *Cupressus arizonica*, which is 20 ft. high, illustrates clearly the dense, low shelter obtained, the type of shelter which is needed most urgently all over the Plains areas of the South Island.

On a farm in the Ruawai district the value of certified rye-grass is well exemplified. In two fields alongside each other a pasture mixture was sown down four years ago. One was sown with certified rye-grass in the mixture, the other with Canterbury seed, non-certified. The two fields have received practically the same treatment. The paddock in which the certified rye-grass was sown now possesses the desirable rye-grass-white-clover pasture, with sufficient but not too much paspalum. The other possesses little rye-grass, is paspalum-dominant, which grows rank and is inclined to smother the white clover. Thus it appears that on such alluvial clay soils, to obtain that essential type of pasture so desirable and also so highly productive in North Auckland, certified rye-grass must be used.

# BLACK-CURRANT-BUD EELWORM IN NEW ZEALAND.

J. MUGGERIDGE and W. COTTIER, Plant Research Bureau.

IN the spring of 1933 a few cuttings from black-currant bushes were received at this laboratory from the Orchard Instructor at Masterton. These were suspected of being infested by the mite *Eriophyes ribis*, which in other parts of the world causes "big-bud" in these plants, the typical condition being an abnormal size in the terminal buds of shoots. A close examination of these buds showed, however, that they were infested by eelworms, in some cases very heavily. In subsequent cuttings received we were unable to find eelworms, and there was a further suggestion that the trouble was caused by Eriophyid mites. Material was sent to England in 1935, but it arrived in too dried up a condition for accurate diagnosis. More specimens received at the laboratory in the early part of 1937 proved again to be heavily infested by eelworms, the symptoms strongly suggesting that the cause of the trouble was the eelworm *Aphelenchoides ribes* Taylor, a pest of black-currant buds hitherto recorded from Britain only, where it was first found in 1917. Material again sent to England was examined by Dr. Goodey, of the Imperial Institute of Agricultural Parasitology, and he found the eelworms present in the buds, in some cases in large numbers. In all cases they proved to be the black-currant-bud eelworm (*Aphelenchoides ribes* Taylor). We have also received specimens of this eelworm on black-currant cuttings from Hastings, Hawke's Bay, but we are unable to say how widespread this pest is in other parts of the Dominion.

## SYMPTOMS OF ATTACK.

The presence of infested buds has a great influence on the growth of the wood buds, especially in the spring and early summer. The general effect is to produce a very uneven type of growth, healthy shoots alternating with dead buds (Fig. 1). If infested buds be cut open they will be found to show a more or less extensive black discoloration in the centres.

Taylor (1917) accurately describes the diseased condition as follows :—

"If . . . a shoot known to be infected with worms is kept under observation in the spring, it is seen that the wood buds which have escaped attack will push into growth. These shoots, proceeding as they do from centres of infection, may grow a few inches and then suddenly wilt and die, owing to the worms piercing the delicate tissues of the young stem and destroying the developing leaves. The concentration of the sap in the unattacked buds below such an abortive shoot usually causes several of the nearest unattacked buds on the old wood to break into shoots. These may, if growth is being rapidly made, attain to the length of from 6 in. to a foot. Upon examination of the minute buds they bear it will be found that few have escaped attack . . .

"The terminal buds on such infected shoots are invariably killed, as are many of those immediately below. If all the buds at the apex of those new shoots are successively attacked (and such is a frequent occurrence) the shoot dies back to the nearest unattacked bud. The new basal wood, which considerably influences the yield of fruit in black currants, is similarly attacked and destroyed.

FIG. 1. SHOWING TYPE OF GROWTH CAUSED BY EELWORM INFESTATION. NOTE THAT SOME BUDS HAVE PRODUCED LEAFY SHOOTS, WHILE OTHERS HAVE FAILED TO DEVELOP. NUMBERS OF THESE LATTER HAVE WITHERED AWAY.

[*Photo by H. Drake.*

"Repeated efforts are thus being made by the tree during the growing season to produce new wood, with the result that an irregular growth of twigs is produced about a diseased area. During the resting season no alteration takes place in the growth of the tree, but the worms continue to destroy the buds. In the spring long lines of unexpanding buds, interspersed with a few which are developing normally, show the effect of the activity of the worms during the months when the trees remain dormant.

"The irregularity in the growth of the wood is most characteristic of an eelworm attack, and the presence of dead or partially dead shoots, with the bark shrivelled, the end tapering and thread-like, together with a cluster of weak shoots, are typical signs of the presence of the black-currant eelworm."

## The Causal Organism and its Habits.

The eelworms are very minute in size, not discernible as such to the naked eye, and their true nature can be made out only under magnification. When infested material is teased up with water and viewed through the microscope the colourless and more or less transparent worms appear as in Fig. 2. When adult the worms are approximately 1 mm. long. In infested buds all stages from the egg up to the fully-grown adult are present.

According to Taylor (*loc. cit.*) the worms enter the buds through the spaces between the scale-leaves. They either remain feeding amongst the scale-leaves or else pass on to the inner and true leaves. In the first case, the scale-leaves themselves being more or less unattractive for feeding, the eelworms congregate at the base of them and feed on the succulent tissue there. The damage done to these parts results in the decay of this tissue and the water and food supply being thus cut off from the buds these structures die and decay, the worms subsequently multiplying in the decaying material. When the true inner leaves of the bud are attacked the tissues there are discoloured and finally destroyed. The eelworms do not feed internally in the tissues of the bud-leaves, but live ectoparasitically between them.

When a bud has been destroyed the worms migrate to adjacent buds either above or below the one they have left. For this they require the presence of films of moisture on the stems, and migration is entirely dependent on the presence of such conditions produced by rain, dew, &c. Having reached healthy buds the worms quickly set to work to destroy them in turn.

The time taken to destroy buds varies with the state of growth these are in. In the spring, when the new buds are very small, they are killed rapidly, but later on when the buds are freely developed they can remain alive much longer.

The worms are at work in buds all the year round, but in the springtime they seem to be most active, and this is the time of the year when most reproduction is going on.

Under dry conditions the worms can exist in a dessicated but live state for several months, so that in cases where they have killed buds and are ready to migrate, but are unable to do so on account of the dry state of the bushes, they will assume this dessicated resting condition. As soon as sufficient moisture is present they will revive, however, and take on active movement again and are quite able to migrate to adjacent buds and multiply there.

## Dispersion.

The eelworm can be disseminated by striking cuttings containing infested buds and very probably by the handling of healthy bushes and infested ones in turn, such as is bound to occur in pruning

operations. This dissemination would be much more effective if the bushes were handled or pruned when they are moist. Heavy rains can wash or splash migrating worms from one stem to another or on to the ground whence they can crawl in the moisture films to other bushes. When the worms are in a dessicated state washing off by rain and splashing to adjacent parts is all the more easy, as in the dried condition they float very easily on the surface of the water. It is also suggested that wind may play a part in spreading worms, as in dry weather dead buds dry up rapidly and the scale-leaves quickly become brittle and are broken off and carried away by the slightest movement, taking with them colonies of dessicated worms in a quiescent condition.

FIG. 2. PHOTOGRAPH THROUGH THE MICROSCOPE SHOWING TYPICAL INDIVIDUALS OF THE BLACK-CURRANT EELWORM. × 70 (APPROX.).

## CONTROL.

As far as the writers are aware, no work has been done on the control of this particular pest in any part of the world. Recent correspondence with the Imperial Institute of Agricultural Parasitology in England has shown that English authorities agree that possible remedies can only be suggested and that nothing positive can be asserted. It would seem that possible means of control might be along the following lines, and this is all that can be put forward to growers at the present time :—

(1) The use of sprays and chemical dips.
(2) Hot-water treatment of one- to two-year-old plants in the nursery before placing out in permanent beds.
(3) General hygienic measures.

The above methods are suggested from a consideration of those measures that have been adopted for closely related plant parasitic eelworms—*e.g.*, the chrysanthemum eelworm (*Aphelenchoides ritzema-bosi*). There seems no reason to suppose, provided the worms can be reached, that the black-currant-bud eelworm cannot be killed by treatments that control such closely related species.

(1) *Use of Sprays and Chemical Dips.*—Sprays at best have been found to be a doubtful quantity and only partially successful against this type of eelworm. Goodey (1933), in discussing the position with regard to chrysanthemum eelworm, states that a thorough investigation of spraying-materials tried has shown that most of them are useless. This is the case with sulphur and copper compounds, potassium permanganate (Condy's crystals), barium chloride, picric acid, sodium carbonate, limewater, mercury, arsenic, and nicotine preparations in soft-soap solutions at concentrations harmless to the plant. The only material which might offer some promise of success is a 3-per-cent. solution of ammonia. This has been used by some workers on chrysanthemums without injuring the plants, and favourable results have been claimed in killing the worms. The difficulty with spraying for black-currant-bud eelworm will be to reach the worms that are hidden between the bud-leaves. It seems that the best that can be hoped for is a kill of those worms that are caught in the act of migrating from one bud to another, and this will provide relief but not cure. It is suggested that those who might wish to try a spray would be well advised to try the ammonia solution, using ordinary ammonia 3 parts to 100 parts of water. At first use the spray carefully on a few bushes only, as it is not known what the effect of the spray on black currants will be. It can be readily understood that frequent sprayings at regular intervals will be required, as the idea is to catch the worms as they are migrating.

Since this migration is going on at all times, spraying will theoretically bea dvisable throughout the year, but the most important period will be in the spring, when the bushes are beginning to shoot.

Miles (1935) says that in certain quarters it is claimed that dipping chrysanthemum - cuttings in a potassium - sulphocarbonate solution will rid them of eelworms. However, it is not yet accepted as a proved case, but if the chemical will kill chrysanthemum eelworms where the worms are actually within the tissue, it is considered reasonable to suppose that it will also kill black-currant eelworms where the worms live between the bud-leaves and not actually within the plant-tissue. It may be worth while to try dipping black-currant cuttings in the solution prior to striking. The dip is prepared by dissolving ½ lb. potassium sulphocarbonate in 3 gallons of water in which ½ lb. of soft soap has been dissolved. Soak the cutting in this for one hour.

(2) *Hot-water Treatment.*—This method is drastic on most kinds of plants and could be tried, of course, only on young black currants before they are put out into permanent beds. In all likelihood hot-water treatment of unrooted cuttings would result in the death of all cuttings treated, and it is necessary that they should have been struck and grown a strong root system before being immersed

in the hot water. After a consideration of the available information it would seem that only young plants one or two years old could be submitted to hot water at a temperature of 110°–112° F. for thirty minutes. Do not immerse the roots, and to prevent their drying out wrap them in damp cloth. For success it is necessary to keep the temperature constant within the limits set, and to do this without a thermostatically controlled bath might be laborious, especially considering that the volume of warm water might be necessarily fairly large. To keep down the volume of water it would be advisable to prune back the young bushes as hard as possible before treatment. To carry out the treatment successfully it is necessary that the thermometer used should be accurate and the source of heat must be such that it can be controlled satisfactorily. If young bushes with strong rooting-systems are used, pruned back and with their branches tied in a bunch to conserve space, it should be possible to carry out the treatment with reasonable efficiency. Hot water is very effective in killing eelworms, and although it is usually drastic on plants one can be satisfied that if the treatment is carried out properly there is little chance of survival of the pest. Treatment must be carried out in the dormant season. No experimental work has been carried out to discover the effect of hot water on the subsequent growth of black-currant plants, and growers are advised to proceed cautiously until something more definite can be put forward.

(3) *General Hygienic Measures.*—On established plants in permanent positions in black-currant beds it seems that little can be done beyond cutting out and burning all infested parts and periodically spraying with the ammonia solution described above, if such should prove suitable for application to black currants. A careful watch should be kept at all seasons of the year for signs of eelworm attack, and all shoots bearing any signs of weak or dead buds or any other suspicious symptoms should be carefully removed and burnt. Especially in the spring is it necessary to keep a careful watch, and all branches bearing weak and spindly growth from buds should be promptly cut out. Handling of any kind such as is necessary in pruning should not be done unless the bushes are dry. If such operations are carried out under moist conditions it can readily be understood from what has gone before how easy it would be to transfer worms from one shoot to another or from one bush to another. Do not leave prunings on the ground, as worms can migrate from these to adjacent healthy growth, especially to underground shoots. Gather up all cut pieces and destroy them. When putting out new plants be careful to place them well away from infested bushes.

Hygiene demands the avoidance of indiscriminate handling at all times, and these measures and the cutting-out of all suspected growth will help greatly to check the spread of the eelworm.

ACKNOWLEDGMENTS.

The writers are indebted to the Imperial Institute of Agricultural Parasitology in England for the identification of the black-currant-bud eelworm and also for various suggestions on possible control methods.

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# PREVENTION OF FROST DAMAGE IN ORCHARDS.

## VISIT TO WESTERN STATES OF AMERICA.

W. R. LLOYD WILLIAMS, Orchard Instructor, Alexandra.

IT may safely be stated that preventive measures against frost damage with fuel oil as the heating medium were commenced commercially in New Zealand orchards as a result of the destructive spring frosts of 1926 in Central Otago. The writer, arriving in the district a few days after the visitation, was convinced that it was one of the major problems. Contacts were immediately made with authorities in California, notably Mr. W. R. Schoonover, with whom an intermittent correspondence has since been carried on, with great benefit to the industry here. The deciding factor to growers was the initiation of an experiment in orchard-heating financed by the Department of Agriculture. The experiment was conducted by the writer with lard-pail heaters burning oil at the orchard of Mr. W. Bringans during the springs of 1927 and 1928. Annually the area protected in Central Otago was slowly but steadily increased until 1933, when another disastrous frost occurred, after which the area protected was increased more rapidly.

Last spring, 1936, certain areas in Central Otago were again considerably damaged and, in addition, injury was caused over a large area in Hawke's Bay. As a result of these all-too-frequent occurrences a large number of growers who had not previously used protective measures desired to acquire equipment, but before incurring the expenditure that this would entail, an expenditure which many growers in consequence of their periodically reduced crops and low fruit prices could ill afford, it was felt that the industry should be in possession of the latest information on the subject. To this end the Government was asked to allow a departmental officer to visit the Western States of America and investigate the methods employed in this connection. As a result I was deputed to proceed to Oregon and California, via Vancouver, leaving Auckland on 20th April "for the purpose of investigating the latest methods adopted in that country by way of protecting fruit crops, particularly deciduous fruit, against frost damage." As it was considered necessary to bring back the information in time for the coming season's danger period, the visit was limited to a return to New Zealand by the end of June.

Time was spent with officials and growers in the deciduous orchards of Medford (Oregon), Wenatchee and Yakima (Washington), and Southern California, also the citrus-groves of the latter State, and contacts were made with the leading authorities on frost-prevention work, including those of the Departments of Agriculture and at the California University and its experiment stations at Riverside and Davis.

There is no doubt that frost-prevention is a very important factor in orchard-management in certain fruitgrowing areas, and it is equally true that where standard methods have been efficiently applied a satisfactory measure of success has been achieved.

### Two Main Principles.

The two main principles involved in frost-prevention are (*a*) prevention of heat-losses and (*b*) addition of heat. The former method is practised to a limited extent in the form of screens of various sorts, such as scrim, paper, &c., soiling-up of low-grown crops, and water vapour. Smoke, including chemical smoke or screens as used in the war, has been proved of no value except for the very lightest frosts. Glasshouses are a good example of the prevention of heat-losses.

In orchards the most popular methods are by adding heat in some form or another. Undoubtedly the fuel in most general use for orchard heating, whether for deciduous or citrus, is a marine Diesel oil, similar to that in use in New Zealand, but somewhat more refined. The "lard-pail" type, or "smudge-pot" as it is generally called, is the most generally used oil-burner for deciduous fruits. It is emphasized by the best authorities that, except for the smoke and soot nuisance, these heaters give as satisfactory, and usually cheaper, results for oil-burning as any on the market, including the much higher-priced types. Larger pots are mostly used without flame spreaders and they are spaced farther apart than in New Zealand. This method certainly reduces labour, but the writer was advised that our method was safer under our conditions, especially if the inversion is poor, as is often the case on the first night of a series of frosts.

More expensive equipment, such as high and low stack heaters, and those fed through piping reticulated through the orchard from a central storage tank, are only used in deciduous orchards to a limited extent. Millions are in use in the citrus groves on account of the longer burns necessary in winter time and, when properly used, of their almost complete smokelessness.

Solid fuels are also used with success in some orchards, the favourite being petroleum-coke, a production of gasoline "cracking" plants. Considerable improvements have recently been made in solid-fuel heaters, improved draught is available and fires can be extinguished by a device which excludes the air.

Other methods of orchard-heating were also investigated.

### Electricity impracticable.

Electric heating is entirely impracticable on account of the enormous amount of electricity required to heat even a small orchard.

Air-circulators, or wind-machines, with large propellers for mixing the upper warm air with the lower cold air, and later models with furnaces burning oil attached, were seen.

A liquid-petroleum gas piped throughout the orchard from a reservoir burns a propane-butane combination.

An example of central heating of orchards with hot air was investigated. It consists of two small brick furnaces which are supplied with a mixture of oil and air through burners on the side. Fans draw off the heated air and discharge it into two mains, which feed cross laterals

along each row. In these laterals are holes for the warm air to circulate through the trees. The outfit has proved successful over a number of years.

Thermometers and frost alarms were looked into and the degree of damage done at different temperatures at varying stages of growth. Considerable work has been done by officers of the United States Weather Bureau in this connection, and until we create our own table of damaging temperatures we must avail ourselves of their figures as a basis. Much, however, needs to be done to co-ordinate these temperatures with our own, the first step being to improve and standardize the type of thermometer shelters in use in New Zealand orchards.

Up to the abnormal frosts of January, 1937, in the citrus areas of California, it may be said that for a number of years the principal avenue for official research energy and money into frost-prevention methods was in the direction of improving the types of oil-burners, in obtaining greater heat, in improving combustion, and, as a result, combating the smoke nuisance—the latter especially appearing to be the main goal. Much has been done in this direction ; new and better types of burners have been evolved and improvements made to old ones, resulting in an appreciable lessening of the smoke nuisance. Consider the extent of the oil industry, the cheapness of this fuel, and its comparative ease of transport and use, the capital sunk into plant established for the manufacture of the present type of burner and into the millions of these oil-burners in stock in the orchards, and it can be appreciated why research has not materially extended into wider fields. Great work has been done in this connection by the Engineering Branch of the Davis Experiment Station of the University of California in conjunction with Mr. Schoonover and others. Intensive research is now taking place into new methods. The first big preliminary move is a complete survey of orchard-heater performance by means of answers to a comprehensive questionnaire taken by officers from every person using frost-prevention appliances.

It is impossible to estimate the value of the services of the small band of specially trained United States Weather Bureau men, under Mr. Floyd D. Young, who constitute the Fruit Frost Service. Men are stationed in various districts during the danger period and broadcast the necessary information. Growers depend wholly on these forecasts for orchard heating.

## SUMMARY.

Smoke is of no practical value for frost-prevention.

Water is of use only in light frosts and in cases of emergency.

Electricity is too expensive.

Air-circulation has not proved satisfactory, and is very costly. Newer types, which will be still more costly, are being tried.

Lard-pail oil-heaters are still equal to any other type for deciduous fruits.

Tall stack oil-heaters are too expensive for our use.

Low stack oil-heaters will eliminate the smoke nuisance at a reasonable cost.

Liquid petroleum-gas (propane-butane) is too costly to install and maintain in this country—supplies are not dependable and the material very inflammable.

Hot air (central heating) has proved satisfactory in the one instance investigated. It is costly to install, but very cheap and clean to run.

Coal, coke, wood, &c., are used in cases of emergency only.

Carbon briquettes are not much used. Supply not dependable.

Petroleum coke briquettes are the most satisfactory solid fuel.

Coal briquettes, if used with proper heaters, should prove quite satisfactory, and if the prices of heaters and briquettes are reasonable will probably prove cheaper than oil. Also makes use of a New Zealand product. With a view to obtaining a more complete combustion the use of nitrate of soda or similar agent in the manufacture of bricketts such as is being experimented with elsewhere should be worthy of a trial in New Zealand.

Thermometers and alarms must be tested and be accurate to a half degree.

Thermometer shelters of a more standard type are required. Research into damaging temperatures is needed.

This opportunity is taken to sincerely acknowledge the really extraordinary assistance given by all with whom contact was made. This is especially true of all officers of the Departments of Agriculture and Universities of the States visited, United States Extension officers, and Fruit Frost Service men. Nothing appeared to be too much trouble, no distance too far to travel, no information too hard to obtain, to make the results of the visit successful.

## SUGAR BEET AS A PIG FEED.

A crop of sugar beet grown on the Waimate West Demonstration Farm for the purpose of beet-sugar investigation is creating interest as a feed for pigs.

It is the usual farm practice to winter store pigs in open, small, grass paddock runs, with a ration of mangels, carrots, and whey.

This year, however, root-growing is confined to the above area of sugar beet, with the exception of a very small area of carrots.

A start was made in feeding sugar beet to the pigs during May last, and although at the commencement a few carrots were fed out with the beet the pigs selected and ate the sugar beet prior to the carrots.

The Manager states that the pigs are particularly partial to sugar beet, and he has never had pigs to winter and thrive so well. A total of twenty-two store pigs and one sow with a litter of nine are being regularly fed with sugar beet. The total amount fed in conjunction with whey is from 65 lb. to 75 lb. per day, and the grass run area is approximately 1½ acres.

The beet is lifted, leaves topped, and allowed to ripen some ten days prior to feeding.

Experience to date is such that sugar beet presents possibilities as a valuable pig feed.

—*J. E. Davies, Hawera.*

A combination of subterranean clover and swedes was noted in the Apiti district. The growth of the clover was very strong, making a dense cover between the rows, even though suffering slightly from some of the exceptionally heavy frosts experienced in the district. The subterranean clover was sown in mistake for chou-moellier seed, and the evidence noted from the mistake makes it appear as if it might be a combination worth consideration.

# INVESTIGATION OF THE RELIABILITY OF THE "PICRIC-ACID TEST" FOR DISTINGUISHING STRAINS OF WHITE CLOVER IN NEW ZEALAND.

N. R. Foy, Seed Analyst, and E. O. C. Hyde, Assistant Seed Analyst.

It is a matter of common observation that the individuals comprising a species, while showing a necessary degree of conformity to the specific type, display many inherent variations. Because of this variability it is possible by intelligent selection to obtain the more valuable strains from a useful species. This selection of superior strains has been carried out with great thoroughness with many species of plants, but it is only of recent years that the work has been undertaken in a systematic manner with our pasture plants.

*Trifolium repens*, or white clover, the most important leguminous species in our pastures, has proved a very profitable subject for this work of strain-selection. Davies and Levy(2) have made a study of this species in New Zealand, separating local strains and comparing them with others from Europe.

The characteristics to which attention was mainly devoted were :—

(1) Capacity for herbage production.
(2) Seasonal fluctuations in herbage production.
(3) Ability to persist under grazing and competition with other pasture plants.

On the basis of variation in these properties it was found possible to group the different forms of white clover under six types, the occurrence and uses of which they have described.

Davies and Levy report that the best New Zealand strains are excellent in all respects for permanent pasture of fertile land. The capacity for herbage-production is high, and production is maintained at a relatively high level during the critical periods in summer and winter. Plants of these strains are also well adapted to survive and produce herbage abundantly in mixed pastures of vigorous growth.

The poorer strains have a relatively low capacity for herbage-production. They show great seasonal fluctuations in production, there being little growth in late summer and winter. Furthermore, these strains of white clover are incapable of persisting in a pasture where there is little opportunity for regeneration from seed.

After making an intensive survey Davies and Levy reported that in about one-tenth of the white-clover-seed crop of New Zealand the best strains were found to preponderate. Six-tenths of the crop was of a poor strain, but little better than the bulk of the European seed imported into New Zealand. In about three-tenths there was an admixture of good and inferior strains.

A need was felt for some reliable means whereby the strain represented in a line of white-clover seed might be rapidly determined. Work was undertaken by the Department of Agriculture with a view to solving the problem. The present article records the results of an investigation by the Seed-testing Station of the possibilities of a chemical test for distinguishing the strains of white clover at an early seedling stage.

## Review of Literature.

It has long been known that the tissues of some plants contain small quantities of a glucoside which, under certain conditions, as when the tissue is crushed, is broken down by associated enzymes, one of the products of this decomposition being hydrocyanic acid gas or prussic acid (HCN.)

The presence of a cyanogenetic glucoside in wild white clover was first reported by Mirande(5) in 1912. The occurrence of the glucoside in white-clover plants of various origin was investigated more fully by Pethybridge(6) using Guinard's test for detecting the evolution of HCN from seedlings. It was found that seedlings of the strain "Kentish wild white clover" invariably gave a positive reaction, while most samples of ordinary cultivated white clover of English origin gave a negative result. Sampson(7), using the same technique as Pethybridge, found that of fourteen samples of New Zealand seed, all produced cyanaphoric seedlings.

Doak(3) in 1933 reported the results of a very thorough investigation of the occurrence of the cyanogenetic glucoside in New Zealand white clover. Quantitative determinations were made of the amount of HCN present in herbage from plots and from individual plants. It was shown that the HCN content of herbage from plots established from different lots of New Zealand seed varied over a wide range—namely, from 10 parts per million to 130 parts per million. Furthermore, it was shown that there existed a high measure of correlation between HCN content and strain. Plots classed as "mother seed" showed a hydrocyanic-acid content of 70 to 130 parts per million; plots classed as "permanent pasture," 30 to 70 parts per million; rejected plots, 10 to 30 parts per million.

## Material.

The seed used in the present investigation comprised some seven hundred samples which had been used by the Agrostologist to establish plots for strain trials. The seed was all of New Zealand origin, and each sample was representative of the crop from a single known field. Since most of the samples came from old pastures and had been submitted for plot trial to determine whether the seed was eligible for certification, the material was, on the whole, above average quality.

## Methods.

In the present studies the technique described by Pethybridge(6) was employed with minor modifications. Seedlings were prepared for the test by growing them from seed for eight days in diffused daylight in an incubator of the Copenhagen type. Into each of four small test tubes fifty seedlings were lightly crushed. Two or three drops of toluene were then added to kill the tissues and prevent decay. Into each tube was then suspended a strip of filter paper 2½ in. long by ¼ in. wide. To prepare this paper sheets of filter-paper were dipped into a solution of 1 part of picric acid and 10 parts of anhydrous sodium carbonate in 200 parts of distilled water. The paper was then cut into strips and was stored and used in a moist condition. The tubes were sealed with rubber stoppers, numbered, and placed in an incubator at 30° C. for forty-eight hours. If present, the cyanogenetic glucoside is hydrolysed under the influence of the appropriate enzymes, and the gaseous hydrocyanic

acid is liberated. This gas, reacting chemically with the substances in the filter paper, forms a compound which gives the paper a reddish-brown colour. In this way the presence of quantities of hydrocyanic acid may be detected. The intensity of the coloration of the paper depends on the amount of hydrocyanic acid liberated, and thus it is possible to determine colorometrically the relative amounts of hydrocyanic acid produced by different samples. An arbitrary scale of colour shades was established which divided the material examined into seven groups. The colour shade at the points dividing the groups were fixed by preparing a series of colour standards.

Several series of experimental tests were conducted to determine what factors might be capable of causing variation in the intensity of the reaction. It was observed that the temperature at which the tubes were incubated was a matter of importance. The greatest intensity of reaction was produced by incubation for forty-eight hours at 30° C. At room temperature the coloration of the paper was distinctly lighter, while at a temperature of 10° C. only a faint reaction was obtained after prolonged incubation of highly cyanophoric material. The moistness of the paper strips was also found to be important. If the paper was too dry the intensity of the reaction was reduced. On the other hand, moderate wilting of the seedlings and also the failure to add toluene to the crushed seedlings in some instances produced no perceptible difference in the reaction. When reasonable care is taken in preparing the material and carrying out the tests there is rarely any considerable variation among a number of tests of one sample.

It has been stated already that the white-clover seed samples used in this investigation were at about the same time subjected to plot trial by the Agrostologist and classified according to the standards employed in the seed-certification scheme in operation at that time. Seed was approved for certification when the better types—namely, types 1 and 2—predominated in the plot. Most of these samples also contained some of type 3. The best samples containing a large proportion of type 1 were classed as mother seed (M.S.); while the others were classed as permanent pasture (P.P.). The samples of inferior quality, composed largely of type 3, were classed reject (R.).

## Results.

During the year 1935, 463 samples of seed for which final plot trial reports had been made available were submitted to the test. Table I summarizes the results. It will be seen that there is a high measure of correlation between the grading on plot trial and the classification based upon the "picric acid" test. In other words, a high positive correlation between agronomic quality and cyanogenetic glucoside content is demonstrated. Doak(2) has shown that a similar measure of correlation exists between the hydrocyanic-acid content of herbage and the quality of the strain.

"Mother seed," samples of which there was a total of 66, fell almost equally into Classes 5 and 6, and none fell below Class 5.

Samples placed in the "permanent pasture" grade by the plot trial were predominantly of Class 4, although some are found as high as Class 6 and others as low as Class 2. Twenty-nine samples out of a total of 181 in this group fell below Class 4.

All of the 216 samples rejected on plot trial fell below Class 4.

During the year 1936 comparative tests were carried out on a further group of samples. The experience gained during the previous year's work, together with information obtained from experiments conducted with a view to improving the technique, made it possible to produce more consistent and reliable results than was possible the previous season.

Table II summarizes the results obtained for the 234 samples tested during the past year and demonstrates again the strong positive correlation between the grading by plot trial and the classification based upon the intensity of the reaction in the chemical test. The position is closely parallel to that shown in Table I. The principal differences are as follows: The proportion of "mother seed" samples falling in Class 6 is considerably greater. The proportion of "permanent pasture" samples falling into Class 6 under the chemical test is much smaller, there being only one such in a total of 126. Finally, a small proportion of the samples rejected on plot trial (4 in 90) fell into Class 4 under the chemical test.

In Table III an analysis is made of the samples of each certification grade. The left-hand column gives the composition of the lines in terms of the types to which allusion was made in the introductory section of this article. The groups are arranged according to the predominance of the superior types of plant.

It will be observed that in "mother seed" samples the type 1 predominates, while in the rejected material type 3 predominates. Among samples of the "permanent pasture" grade those showing a higher content of type 1 give a stronger reaction under picric-acid test than do those which comprise largely the lower types.

The relative HCN content of types 2 and 3 is a matter of interest. The present data do not, however, throw much light on this question. A comparison of the distribution according to chemical reaction of samples with a type composition of 2 plus 3 and 3 plus 2 respectively, and again those samples with a type composition of 2 plus 3 plus 1, and 3 plus 2 plus 1 respectively, indicates that type 2 is more highly cyanophoric than is type 3.

## USE OF PICRIC-ACID TEST IN THE CERTIFICATION OF WHITE-CLOVER SEED.

Since the commencement of the present year the picric-acid test has been used by the Department of Agriculture as the basis of qualification of white-clover seed for the purposes of certification. Lines falling into Class 6 under the test qualify for the "mother seed" grade. Lines falling into Classes 4 and 5 are included in the "permanent pasture" grade. Other lines giving a lower reaction are rejected from certification.

To define the grades "border-line" control, samples are included with each batch of samples tested. A Lovibond tintometer has been found of some assistance in comparing with the controls tests which lie closely to the border-line. When this instrument is used the colouring-material is leached from the paper strips

with a measured quantity of water, and the samples then compared on the basis of the intensity of the red element in the colour of the solution.

An examination of Table III will show what changes may be expected to result from the change from the plot trial to the chemical test as the basis for the certification of white clover. Of the eighteen lines passed as mother seed on plot trial, thirteen would be so classed by the chemical test and the remaining five are placed in the permanent-pasture grade. Of these five, four have a type constitution of 1 plus 3.

Only one in a total of 126 P.P. lines would be raised to the mother-seed grade, and this line is predominantly of the type 1.

Eighteen of the 126 P.P. lines (14 per cent.) are rejected from certification by the chemical test. Of these, thirteen, or over two-thirds, are composed of type 3 plus type 2.

Of ninety lines rejected on plot trial, all are rejected by the chemical test, except four, which fell in Class 4, and are thus graded P.P.

With twenty-eight lines out of a total of 234 (12 per cent.) differences occur in the grading by plot trial and by chemical test. On the other hand, there is agreement in 88 per cent. of the lines.

*Table I.—Summary of Results from Samples studied during 1934, showing Correlation between the Classification by the Picric-acid Test and the Classification by Plot Trial.*

| — | Classification by Picric-acid Test. | | | | | | | Total. |
|---|---|---|---|---|---|---|---|---|
| | 6. | 5. | 4. | 3. | 2. | 1. | 0. | |
| Grading by plot trial— | | | | | | | | |
| M.S. .. .. | 34 | 32 | .. | .. | .. | .. | .. | 66 |
| P.P. .. .. | 8 | 60 | 84 | 20 | 9 | .. | .. | 181 |
| R. .. .. | .. | .. | .. | 90 | 62 | 64 | .. | 216 |
| Total .. | 42 | 92 | 84 | 110 | 71 | 64 | .. | 463 |

*Table II.—Summary of Results from Samples studied during 1935–36, showing Correlation between the Classification by the Picric-acid Test and the Classification by Plot Trial.*

| — | Classification by Picric-acid Test. | | | | | | | Total. |
|---|---|---|---|---|---|---|---|---|
| | 6. | 5. | 4. | 3. | 2. | 1. | 0. | |
| Grading by plot trial— | | | | | | | | |
| M.S. .. .. | 13 | 5 | .. | .. | .. | .. | .. | 18 |
| P.P. .. .. | 1 | 27 | 80 | 15 | 3 | .. | .. | 126 |
| R. .. .. | .. | .. | 4 | 48 | 25 | 10 | 3 | 90 |
| Total .. | 14 | 32 | 84 | 63 | 28 | 10 | 3 | 234 |

*Table III.—Summary of Results from Samples studied during 1935–36, showing Correlation between Type Composition and Classification by the Picric-acid Test.*

M.S. = Mother seed; P.P. = permanent pasture; R. = rejected.

| Type Composition. | Certification Class. | Classification by Picric-acid Test. | | | | | | Total. |
|---|---|---|---|---|---|---|---|---|
| | | M.S. | P.P. | | R. | | | |
| | | 6. | 5. | 4. | 3. | 2. | 1 + 0. | |
| Classification by plot trial— | | | | | | | | |
| 1 .. | M.S. | 1 | .. | .. | .. | .. | .. | 1 |
| 1+2 | M.S. | 4 | 1 | .. | .. | .. | .. | 5 |
| 1+3 | M.S. | 8 | 4 | .. | .. | .. | .. | 12 |
| 1+3 | P.P. | 1 | 3 | 3 | .. | .. | .. | 7 |
| 1+2+3 | P.P. | .. | 1 | 1 | .. | .. | .. | 2 |
| 3+1 | P.P. | .. | 2 | 8 | 1 | .. | .. | 11 |
| 2+1+3 | P.P. | .. | 1 | 5 | .. | .. | .. | 6 |
| 3+1+2 | P.P. | .. | 2 | 1 | .. | .. | .. | 3 |
| 2+3+1 | P.P. | .. | 9 | 18 | 1 | .. | .. | 28 |
| 3+2+1 | P.P. | .. | 1 | 10 | .. | 1 | .. | 12 |
| 2+3 | P.P. | .. | 8 | 16 | 1 | 1 | .. | 26 |
| 3+2 | P.P. | .. | .. | 18 | 12 | 1 | .. | 31 |
| 3+2 | R. | .. | .. | .. | 5 | 5 | 2 | 12 |
| 3 .. | R. | .. | .. | 4 | 43 | 20 | 11 | 78 |
| Total .. | .. | 14 | 32 | 84 | 63 | 28 | 13 | 234 |

## ACKNOWLEDGMENTS.

The writers wish to acknowledge the generous assistance of Mr. E. B. Levy and Mr. L. W. Gorman.

They are also indebted to Mr. B. W. Doak for advice regarding the technique of the chemical tests.

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**The value of suitable top-dressing to induce clover-growth in pastures, particularly paspalum pastures, is to be observed in North Auckland. Right through the winter where such conditions exist the clover has stimulated the paspalum, and this grass has produced feed right through, whereas paspalum pastures lacking clover are yellowish and are making no growth.**

# NEW-ZEALAND-RAISED SWEET ORANGES.

A. M. W. GREIGG, Orchard Instructor, Auckland.

THE search for a New Zealand sweet orange equal in all respects to imported fruit is the aim of every keen citrus-grower in this country. Whereas one may advocate heat, another the rootstock, soil, or various climatic conditions as the limiting factors, there is one strong advocate for the New Zealand Poorman's orange—he is Mr. Fred. Lippiatt, of Luke Street, Otahuhu. Mr. Lippiatt is a firm believer that the best prospects of obtaining the desired fruit are to be secured from Poorman's sports, specially selected budwood from the better class of tree or the cross-pollination of Poorman's trees with sweet oranges.

Confusion is still apparent in the minds of people as to the difference between New Zealand Poorman's orange and New Zealand grapefruit. There is none other than in quality. An orange-tree imported from India and grown by the late Sir George Grey at Kawau Island bore such a crop of fine oranges, although with a distinct flavour, that the remark was passed, "That's a poor man's orange." Budwood from this tree established the New Zealand Poorman's orange throughout the country. During recent years grapefruit has become popular, especially in the United States, and the suitability of the New Zealand Poorman's orange for grapefruit purposes induced a local firm to popularize the fruit under the name of New Zealand grapefruit. Only good, well-matured fruit should ever be marketed under this name, otherwise the old prejudice against the Poorman's orange will again have to be lived down.

Mr. Lippiatt has held the belief for forty years that a sweet orange adapted to New Zealand conditions could be evolved from the New Zealand Poorman's orange, but it is only during the last ten years that he has started to put that belief into active practice. The New Zealand Poorman's has proved itself a powerful grower and heavy cropper under a wide range of conditions, but hybridization towards an improvement in flavour is necessary in the effort to obtain a New Zealand sweet orange. Mr. Lippiatt appears already to have evolved a sweeter fruit, which, even though it cannot yet be classified as a sweet orange, should improve the demand for New Zealand grapefruit, as according to an authority, Mr. Harvey Turner, fruit-merchant, of Auckland, a sweeter fruit was desirable for the New Zealand grapefruit trade, and Mr. Lippiatt's seedling appears promising for that purpose.

## HISTORY OF SEEDLING.

The history of Mr. Lippiatt's seedling, although not a direct outcome of his theory of a sweeter Poorman's orange, yet throws an interesting light upon the history of the New Zealand Poorman's.

About ten years ago a citrus-grower named Mr. T. W. Hewett, of Aitutaki, Cook Islands, used to market his fruit through the firm of Messrs. Turners and Growers, Auckland. On visiting the markets one day Mr. Harvey Turner directed the attention of Mr. Fred Lippiatt, of Otahuhu, to a very fine grapefruit from a case of mixed fruit sent Mr. Turner from Aitutaki. At lunch that day Messrs. H. Turner,

S. Thompson, F. Lippiatt, and J. W. McMicken sampled this grapefruit, and all were impressed by its fine qualities—large, 8 in. in diameter, thin-skinned, similar in appearance to an Island orange, and very juicy. Mr. Lippiatt was so impressed that he insisted upon taking all the seeds home and planting them there. From the fifteen

TREE RAISED FROM ONE OF MR. LIPPIATT'S ORIGINAL IMPROVEMENT POORMAN'S SEEDLING TREES, SHOWING THE WAY IN WHICH THE SEEDLING HAS GROWN EVEN WHEN PLACED ON A STRONG STOCK. THE BUD IS THE RIGHT-HAND GROWTH, AND THE STOCK THE LEFT.

seeds he obtained sixteen seedlings. Obtaining more seedlings than seeds planted is fairly common in citrus, and is due to the phenomenon known as polyembryony, which arises through the development of embryos from other cells within the ovule. This embryo is haploid and the seedling which grows from it is generally smaller than the

seedling from the fertilized ovum—a diploid cell. Mr. Lippiatt is taking special note of the cases in which two or more seedlings grow from one pip.

The sixteen seedlings showed a wide variation in general characters—foliage, thorns, and nature of growth. Some appeared better, some worse, than existing types of New Zealand citrus. All showed orange, grapefruit, or mandarin foliage in a more or less marked degree. The reason for the wide variation is explained by cross-pollination. Citrus is generally propagated vegetatively or asexually by means of buds in order to reproduce a tree true to type. In the case of planting seeds which are really the fertilized eggs or ova known as the zygote, all the heredity characteristics or genes of both male and female gametes will appear. The New Zealand grapefruit is itself a hybrid between an orange and a pomelo. What, then, could be expected from this Island grapefruit which had been cross-pollinated by the sweet oranges of the Islands. It was on this theory that Mr. Lippiatt was working, and from it he hoped to obtain a wide range of seedlings. This is what actually resulted. To say at this juncture that he hoped to obtain an improved Poorman's or an orange suitable for New Zealand conditions would be quite incorrect. He had no idea what would result. They might all have been useless. It was the system by which many great discoveries have been made—the trial and error method.

INFLUENCE OF HUMIDITY.

The grapefruit succeeds better than the orange under conditions of greater relative humidity. This is shown by the superiority of Florida grapefruit over Californian, whilst the reverse is true regarding oranges, which do better under irrigation conditions. Mr. Lippiatt's seedlings showed their grapefruit ancestry in that the fruit is borne as a cluster or spray, not as individual fruits as with oranges. They also fruited earlier than would Island orange seedlings under similar conditions.

From the sixteen seedlings fruit has now been obtained from nine. Fruit from six of these was valueless and need not be considered further, but fruit from trees numbered 1, 2, and 3 is of interest. To deal with No. 3 first: This tree is at present growing on the property of Mr. R. W. Nicholls, of Mangere, but the remarkable feature about the fruit was that it appeared identical with that of New Zealand Poorman. When Mr. Lippiatt took one fruit of No. 3 and two ordinary Poorman's oranges into Messrs. Turners and Growers, out of half a dozen people not one picked the seedling. When cut and tasted one could not distinguish it from the Poorman's except that the centre is a hollow core, not solid as in Poorman's, and the flesh is a deeper golden colour. How, then, came this fruit from a seedling tree raised from an Island grapefruit to be similar in every way to a New Zealand Poorman's? The history of the New Zealand Poorman's as outlined above shows it to have been imported from India, and inquiries regarding the imported Island grapefruit resulted in the discovery that Mr. Hewett had received his trees as a gift from an Englishman after his return to India following a visit to the Islands. The fruit from these trees is not now sold locally, as

Mr. Hewett has died and his orchard has changed ownership. This fruit resembling the New Zealand Poorman's thus confirms the theory as previously advocated by leading citriculturists that the New Zealand Poorman's is a hybrid or cross between the sweet orange and the Indian pomelo.

Seedlings numbered 1 and 2, however, are now the ones from which Mr. Lippiatt hopes to obtain a finer strain of grapefruit. The fruit obtained was a sweeter grapefruit or a stage nearer the result of a suitable New Zealand sweet orange—that is, one adapted to local conditions, equal to the imported fruit in quality and flavour and suitable to the grower in bearing good regular crops of high quality. Besides being sweeter than New Zealand Poorman's, it is also a good commercial size and thin-skinned. Unfortunately, Nos. 1 and 2 growing on their own roots have died of collar-rot, but before dying No. 1 had set a crop of approximately 260 fruit, indicating it should be a good cropper. The soil of the area is rather heavy and wet, and pomelo or its derivatives is not a rootstock resistant to unfavourable conditions. Realizing that his two best seedlings were dying, Mr. Lippiatt made a fine effort and has saved the valuable budwood of No. 1. The buds were inserted into younger seedlings. This is not a usual procedure, and in normal circumstances would be considered as senseless to put buds of a tree on to a similar rootstock, but these seedlings were all that Mr. Lippiatt had available at the time.

The seedlings were raised from the seed of five cases of similar fruit from a consignment from Aitutaki four years later. These seedlings were sown in a small nursery area at the rear of the house, and, owing to unfortunate circumstances, were neglected for a year or two. Some of the seedlings were given to a nurseryman, who used them as stocks and thus are lost to the industry, others have been given away, but a considerable number remain on the property. The No. 1 budwood has been put on these and the stock or secondary seedling root has been allowed to remain in order to see if any other good-quality fruit result. One remarkable feature, however, of the No. 1 bud is that in all cases it has developed, even after being dormant for a year. It becomes a vigorous shoot and forms naturally a fine tree without any necessary forming by the nurseryman. The No. 1 trees show remarkable vigour, fine foliage, and the black-streaked bark so characteristic of the New Zealand Poorman's. No. 1 was growing on Mr. Lippiatt's property. No. 2 grew at Mr. Graham's across the road. It died as a result of the storm of February, 1936, but fruit borne was practically identical with that of No. 1.

Already the news has spread of this promising seedling, and although one is quite unable to secure any sample fruits until the No. 1 buds again reach fruiting-age, yet several nurserymen are working up the variety on different stocks, so that in a few years the capabilities of this seedling will be seen under varying conditions. Growers are already making inquiries, but another two years will probably elapse before the seedling is released for sale.

In the meantime Mr. Lippiatt has indicated the manner in which progress and research can be made towards finding the ideal New Zealand sweet orange, and to him the citrus industry is indebted for his interest and zeal over the past ten years.

# HALF-YEARLY FERTILIZER RETURNS.

THE following returns have been compiled by the Inspector of Fertilizers, Fields Division, Department of Agriculture, from figures supplied by the courtesy of the Comptroller of Customs :—

(Figures in Tons.)

| Fertilizer. | Origin. | Jan. | Feb. | Mar. | First Quarter. | April. | May. | June. | Second Quarter. | Half-yearly Return. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Phosphates.* | | | | | |
| Rock .. | Gilbert and Ellice Islands | 15,380 | 4,129 | 14,310 | 33,819 | 2,581 | 11,503 | 1,003 | 15,087 | 48,906 |
| | Nauru .. | 9,017 | 6,186 | .. | 15,203 | 15,854 | 11,383 | 38,446 | 65,683 | 80,886 |
| Total .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 129,792 |
| Slag .. | United Kingdom | 155 | 1,050 | 15,703 | 16,908 | 12,638 | 1,729 | 401 | 14,768 | 31,676 |
| | Belgium .. | 225 | 10,435 | 12,303 | 22,963 | 8,260 | 9,115 | 250 | 17,625 | 40,588 |
| Total .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 72,264 |
| Guano .. | United Kingdom | .. | .. | .. | .. | .. | .. | 5 | 5 | 5 |
| | Seychelles .. | .. | 10,379 | . | 10,379 | .. | .. | 2,980 | 2,980 | 13,359 |
| Total .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 13,364 |
| Other phosphatic manures | Egypt . | .. | . | .. | .. | .. | . | 2,700 | 2,700 | 2,700 |
| | Belgium .. | .. | 400 | 3,285 | 3,685 | 1,135 | 3,672 | 625 | 5,432 | 9,117 |
| Total .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 11,817 |
| Total, phosphates .. | | .. | .. | .. | .. | .. | .. | .. | .. | 227,237 |
| | | | | | *Potash.* | | | | | |
| Kainit .. | Belgium .. | .. | .. | 25 | 25 | .. | .. | .. | .. | 25 |
| | U.S.A. .. | .. | 25 | .. | 25 | 50 | .. | 20 | 70 | 95 |
| | Germany .. | .. | 105 | .. | 105 | 20 | 205 | .. | 225 | 330 |
| | France . | 20 | 20 | .. | 40 | .. | .. | 25 | 25 | 65 |
| Total .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 515 |
| Sulphate .. | France .. | 25 | .. | 5 | 30 | 85 | 105 | 25 | 215 | 245 |
| | Germany .. | 10 | 75 | 5 | 90 | 126 | 49 | 161 | 336 | 426 |
| Total .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 671 |
| Muriate .. | France .. | .. | .. | .. | . | 55 | .. | 35 | 90 | 90 |
| | Germany .. | 4 | .. | .. | 4 | 22 | 1 | .. | 23 | 27 |
| Total .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 117 |
| Other .. | France .. | 100 | 780 | 1,400 | 2,280 | 435 | 525 | 450 | 1,410 | 3,690 |
| | Belgium .. | .. | 5 | 30 | 35 | .. | .. | .. | .. | 35 |
| | Germany .. | 35 | 1,437 | 678 | 2,150 | 460 | 922 | 735 | 2,117 | 4,267 |
| Total .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 7,992 |
| Total, potash .. | | .. | .. | .. | .. | .. | .. | .. | .. | 9,295 |
| | | | | | *Nitrogen.* | | | | | |
| Sulphate of ammonia | United Kingdom | 135 | 440 | .. | 575 | 800 | 278 | 450 | 1,528 | 2,103 |
| Nitrate of soda | United Kingdom | 175 | .. | .. | 175 | .. | .. | .. | .. | 175 |
| | Chile .. | .. | 469 | .. | 469 | 115 | 314 | 75 | 504 | 973 |
| | Netherlands .. | 1 | .. | .. | 1 | .. | .. | .. | .. | 1 |
| | U.S.A. .. | .. | .. | 400 | 400 | .. | 50 | 75 | 125 | 525 |
| Total, nitrogen .. | | .. | .. | .. | .. | .. | .. | .. | .. | 3,777 |
| | | | | | *Miscellaneous.* | | | | | |
| Miscellaneous | Australia .. | .. | .. | 10 | 10 | .. | .. | .. | .. | 10 |
| | United Kingdom | 1 | 20 | 13 | 34 | 54 | 42 | 4 | 100 | 134 |
| | India .. | .. | .. | .. | . | .. | .. | 2 | 2 | 2 |
| Total, Miscellaneous .. | | .. | .. | .. | .. | .. | .. | .. | . | 146 |
| Totals .. | .. | 25,283 | 35,955 | 48,167 | 109,405 | 42,690 | 39,893 | 48,467 | 131,050 | 240,455 |

# MOLE DRAINAGE IN THE MANAWATU.

By C. J. HAMBLYN, Fields Superintendent, Palmerston North, and
A. J. GALPIN, Fields Instructor, Palmerston North.

For many years the mole-drain plough has been used in the Rangitikei, Manawatu, and Woodville districts of the Wellington Province in an endeavour to improve cheaply and effectively the drainage on extensive areas of the heavy loam soils which overlie stiff impervious clay subsoils. The bulk of the country on which mole drainage has been practised consists of rolling and flat-topped low hill country bordering the river flats and river terrace land. Much of this country is dissected by narrow valleys and deep depressions, while in other areas the land gently slopes away from the general level to wide open valleys. The majority of the land is ploughable. The soils are fertile, but there is a definite tendency to rapid reversion of pastures to dominant brown-top, due to the excessively wet condition of the surface soil in winter. Rushes are a serious problem, foot-rot is bad in sheep, pastures are frequently badly poached by cattle in wet winters, and the spring growth is backward.

Mole drainage has often given disappointing results from the point of view of lasting improvement, and many well-established farmers have resorted eventually to the much slower, infinitely more expensive, but more lasting method of tile drainage.

Twelve years of practical experience with the mole-drain plough on his property at Colyton in the Manawatu has resulted in the development by Mr. Bruce McLeod of a method of mole drainage which is thorough, very efficient, relatively cheap as compared with tile drainage, and, what is still more important, promises to be lasting.

The guiding principles in Mr. McLeod's method, though simple, are yet of extreme importance in successful and lasting mole drainage. First, the provision of permanent outlets; second, the provision of a definite and uninterrupted fall from the highest point of each mole drain to the outlet; and third, provision of a sufficient force of water especially near the outlets to clear the system of silt at the commencement of the rainy season. Though the actual mole drain will last for many years when drawn in a suitable clay subsoil, it is the gradual accumulation of fine silt which eventually blocks the drains and renders them useless. During dry summers the soil dries out down to the mole drains and the sides tend to flake. At the beginning of the rainy season there is a deposit of silt in the mole drains. This silt cannot be cleared from the system if the outlets are blocked, nor can it be cleared if there is little or no fall. The special tendency to silt up in depressions is the reason for maintaining a steady but definite fall throughout the course of each drain.

Mole drainage of the 300 acres of Mr. McLeod's homestead portion of his farm has recently been completed with the new system. The first paddock was dealt with five years ago. It is believed that the methods adopted will prove of interest and value to farmers in various parts of New Zealand where similar conditions occur, and for this reason are here described and illustrated.

The chief feature of Mr. McLeod's system is the elimination of the usual large number of individual mole-drain outlets which are so liable to blockage. This is done by using one in every four to eight mole drains as an outlet for the group, and, further, the gathering of as many of these outlet drains to discharge at a suitable selected place where a permanent tiled outlet can be put in. In this way the drainage from forty to fifty or more individual mole drains can be collected to discharge at one point, and the number of outlets required for the complete mole drainage of a large area reduced to a minimum. The provision of material such as tiles for permanent outlets is then not costly.

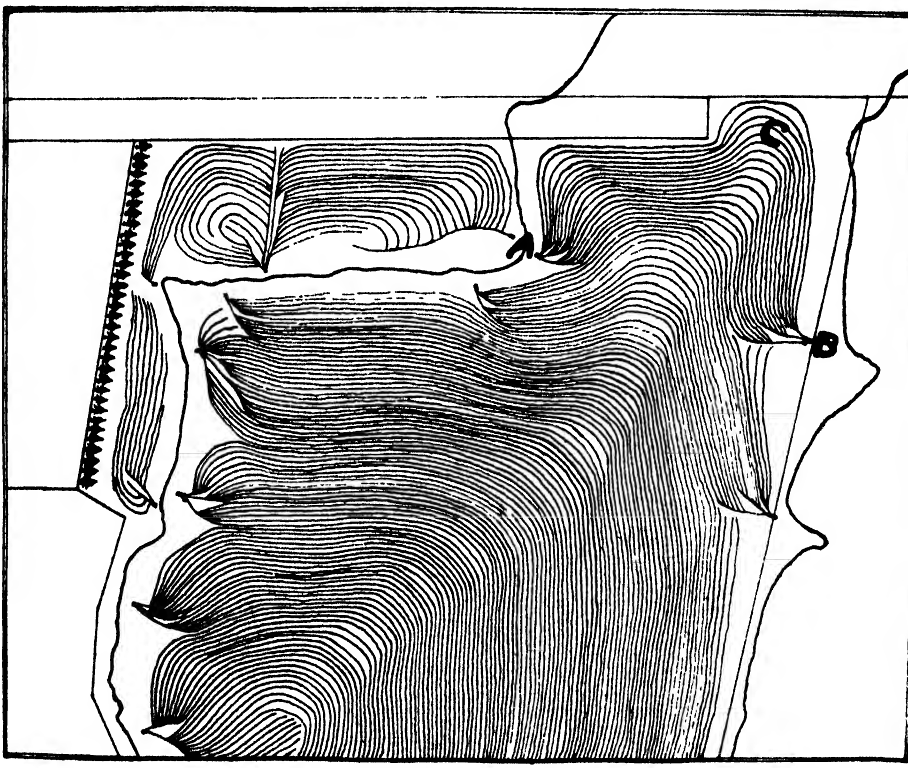



FIG. 1. PORTION OF A COMPLETED SCHEME OF MOLE DRAINAGE ON A 32-ACRE PADDOCK, SHOWING OUTLETS A AND B AND RIDGE C REFERRED TO IN TEXT.

## LAYOUT OF DRAINAGE SCHEME.

A study is made of the paddock or area to be mole-drained, particularly when heavy rain has fallen, and in addition to the selection of suitable locations for outlets, the run and line of the mole drains is roughly schemed out. For this purpose a dumpy level is invaluable. The eye is often deceived regarding the direction of fall.

The number and location of outlets is worked out in relation to the general lie of the country. The possibility of gathering together near the outlets as many mole drains as possible so as to reduce to a minimum the number of main outlets required is the chief guide in selecting these outlets.

As a general principle mole drains are most effective when they run across the steepest slope, but a steady and definite fall must be maintained from the highest point to the outlet with a more decided fall if possible just before the point of discharge. The drainage of such country as at Colyton, gently rolling for the most

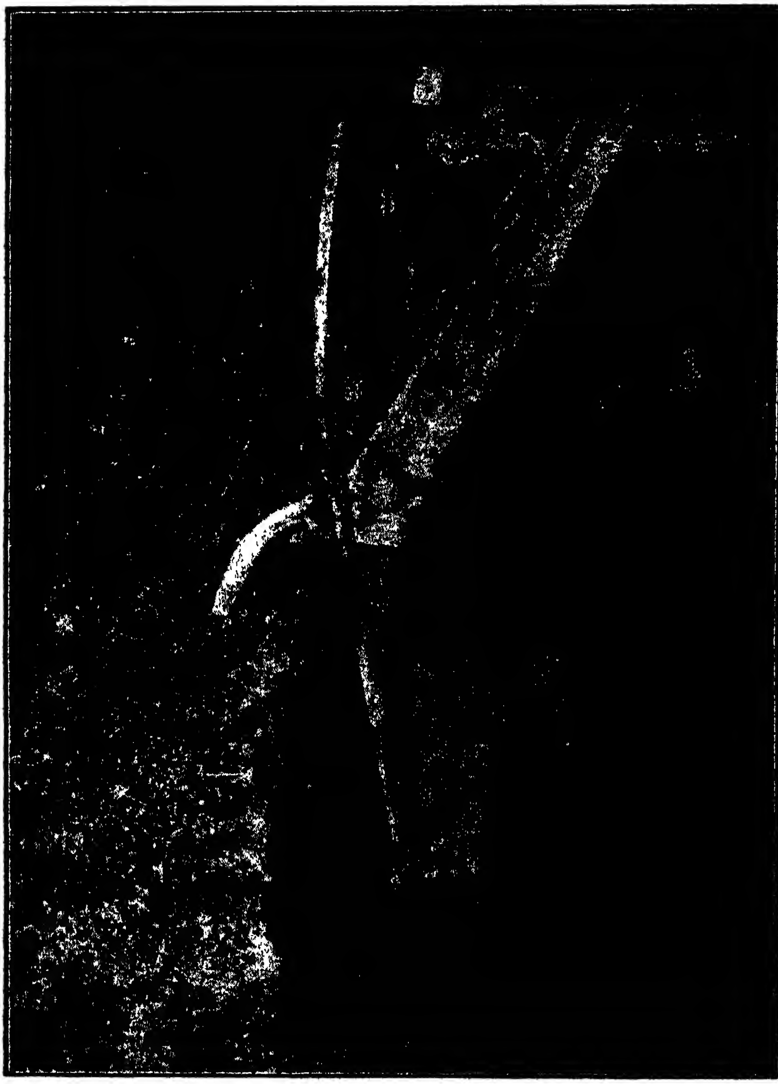


FIG. 2. THE MOLE PLOUGH SET UP IN THE OUTLET READY TO BE DRAWN ACROSS THE BLIND ENDS OF INTERMEDIATE MOLE DRAINS ALREADY DRAWN.

part, with steep slopes to watercourses round the edge of the paddocks, lends itself admirably to the methods developed, but it is surprising how the same system of collecting mole drains for discharge at selected outlets can be adapted to varying conditions on different types of country. It is occasionally necessary to alter the line of fences to give access to suitable outlet locations.

Fig. 1 illustrates portion of a completed scheme of mole drainage on a 32-acre paddock, and shows the location of fences and of the outlets which discharge down the banks bordering the watercourses. The outlets consist of short trenches dug back from the point of discharge whatever distance is required to give easy access for the mole plough.

## DRAWING THE MOLES.

Having fixed the site of two outlets such as A and B in Fig. 1, the mole plough is set up near outlet A and following round the contours and over the ridge at C the plough is tripped and leaves the ground near outlet B. The tractor turns, the plough is set up again near outlet B, and a parallel mole drain is drawn 6 ft. to 9 ft. or up to 11 ft. from the first drain. The plough is next tripped at

FIG. 3. AN OUTLET DRAIN SHOWN CUTTING ACROSS THE ENDS OF FOUR INTERMEDIATE DRAINS AND CONTINUED ON AS AN ORDINARY MOLE DRAIN.

outlet A, and the process repeated until four to six mole drains are drawn. The plough is next set up in the outlet drain A, Fig. 2, and without altering the depth is drawn so as to cut across the blind ends of the drains already drawn. This drain is continued on as an ordinary mole drain to outlet B. The plough is then set up in outlet B, and again the plough is drawn so as to cut across the previously made mole drains. The process is illustrated in Fig. 3. The method of cutting across the ends of groups or fans of completed drains with gathering drains opening into the outlets is continued across the field. New outlets are made use of as the work proceeds. Where it is not possible to work to two outlets the mole is drawn to the highest point required away from the outlet, the tractor turned, and a parallel drain drawn back to the outlet.

FIG. 4. ILLUSTRATES THE HOLE DUG IN THE BLIND END OF THE INTERMEDIATE DRAINS AND THE CLEARANCE OF THE CLAY PLUGS WITH THE CORKSCREW IMPLEMENT.

FIG. 5. A SERIES OF OUTLET MOLE DRAINS DISCHARGING INTO THE OUTLET TRENCH.

Each of these outlet mole drains is connected with 4 in. to 6 in. or more intermediates.

The same method of cutting across the ends of groups of these drains with a mole drain discharging direct into the outlet is adopted. It will be noted that the mole plough is in the ground the whole of the time with the exception of the short turns, and that no time is wasted running back to the outlets empty.

### Linking up Outlet Drains with Intermediate Mole Drains.

Each of the intermediate drains terminates in a blind end, and while the tractor work is going on the work of connecting these intermediates up with the outlet mole drains leading to the outlet ditches is proceeded with. The crossing of these intermediates with a mole drain intended as an outlet results in the complete blocking

FIG. 6. IMPLEMENT USED FOR MAKING HOLES IN TILES AND CUTTING TILES TO LENGTH REQUIRED.

of the first drawn drains, whether the outlet drain is drawn at the same level as in this case, or within 2 in. or 3 in. either above or below. For the purpose of providing for the free passage of water, and, what is more important, for the clearance of silt in later years from the intermediates to the outlet drain, a clean, full-sized connection must be made between them. This is easily and rapidly accomplished with the aid of a simple tool, made in the form of a corkscrew, with a universal joint in the handle.

The points where the outlet drain cuts each intermediate are marked; a hole is dug in the blind end of the intermediate down to the mole drain so as to cut it at a short distance from its junction with the outlet drain. The special corkscrew augur with a universal joint is then used, as illustrated in Fig. 4, to clear

the clay plugs blocking this drain. With the removal of these plugs, if there is sufficient water in the mole drain, it will run into the hole which was dug, but can be diverted to the outlet

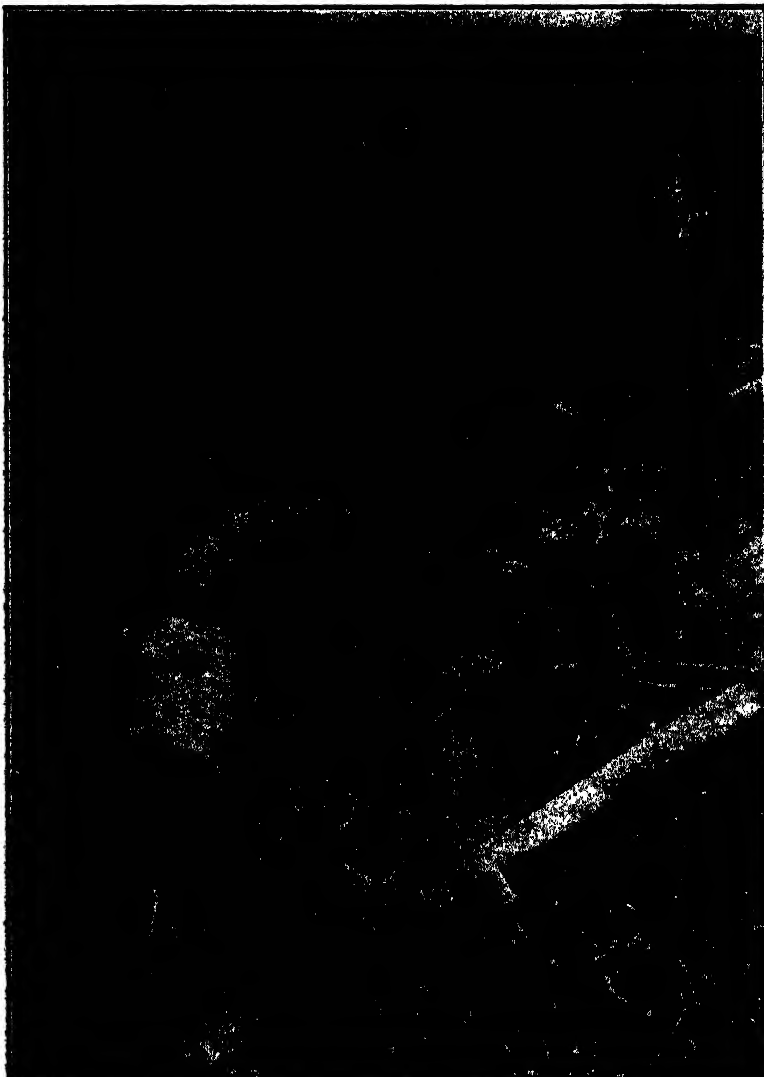


FIG. 7. FOUR-INCH TILES FITTED IN THE OUTLET AND CONNECTIONS WITH THE OUTLET DRAINS.

Note packing of clay round tiles and over the outlets.

drain by plugging up with good clay the open end of the mole drain which has just been cleared. The hole is then filled in and the connection is completed.

### THE PERMANENT OUTLETS.

The final process is the laying of tiles, preferably 4 in. unglazed drain tiles, in each of the outlet ditches to give a permanent

outlet not likely to be trampled in and blocked by cattle or sheep. The bottom of the outlet trench into which the outlet mole drains have been drawn, as shown in Fig. 5, is built up so that the tiles when laid will be close up to these openings. Holes are made with the implement shown in Fig. 6 in the sides of the tiles opposite the mole drain outlets, and pieces of tile or special short lengths of 2½ in. tile are used to make a direct connection between the moles and the tile drain. Sticky clay is then used to pack over the connections and along the length of 4 in. tiles to ensure a permanent job (Fig. 7). The outlet is then filled in. The implement used for cutting tiles to suitable lengths and for cutting

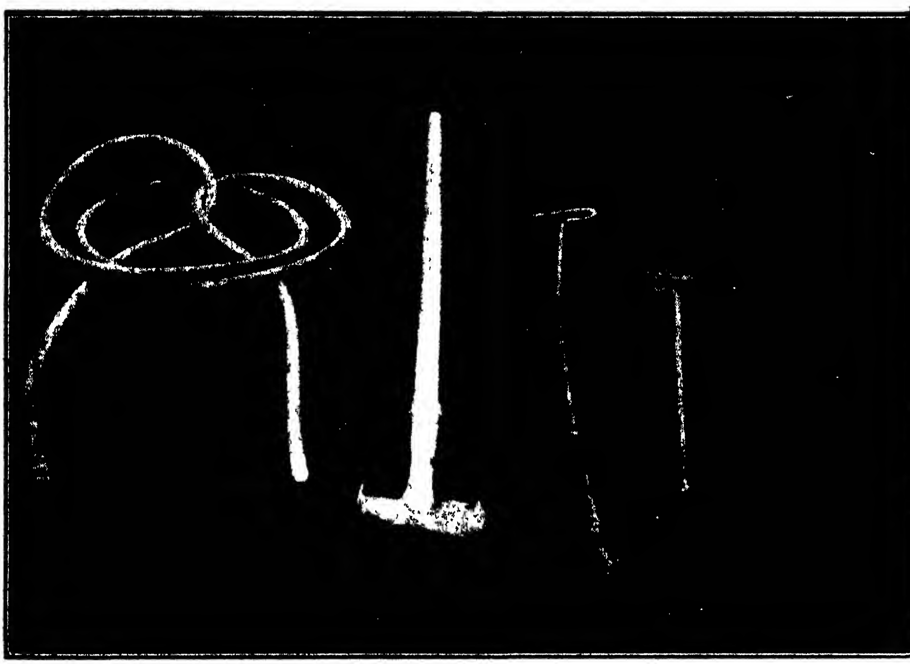


FIG. 8. SOME OF THE OTHER TOOLS USED AND DESCRIBED IN THE TEXT.

holes in the sides of the tiles is made from an ordinary worn mower-knife section fitted to a short handle. The hammer is used to punch out the hole when the outline is sufficiently chipped with the other implement.

The length of ¾ in. hose fitted with a corkscrew at one end and a plug of hardwood at the other is useful for clearing obstructions in the outlet drains when, as sometimes occurs, the plugs are not properly cleared from the intermediates. It is also useful later in clearing obstructions such as silt accumulations near the outlets and in maintaining the drains in good order (Fig. 8).

## Efficiency of this Method of Mole Drainage.

The effectiveness of mole drainage is illustrated in Figs. 9 and 10. Fig. 9 shows the surface of a paddock as yet undrained,

the pasture weak and open, the soil wet and sloppy—ideal conditions for sheep parasites and bad foot-rot, and always liable to rush invasion. Fig. 10 illustrates the conditions on an adjoining field mole-drained for four years and sown to the same good rye-grass and white clover. The rye-grass and clover are flourishing, with little chance of reversion to brown-top or rushes. The surface is dry and firm and able to carry heavy cattle during the winter.

FIG. 9. TYPICAL WINTER CONDITIONS OF UNDRAINED LAND AT COLYTON.

## Permanence and Renewal.

Most of the usual methods of mole drainage on such country had been tried out during some twelve years by Mr. McLeod, including the connection of deeper outlet drains with intermediates by means of a spear or the use of totara slabs placed over the junction when this had been cleared. His experience has been that generally the efficiency of the drainage has improved up to about three years, then there has been a rapid falling-off in the effectiveness. Wet patches appear and spread throughout the field, until the system has to be renewed in about five years. Although the first area drained by the new method has been done for five years only, the fact that there has been a steady improvement in the effectiveness of the drains during this period and that the discharge of water at the outlets after rains is still as good as ever indicates that a much more permanent and satisfactory job has been done. Renewal of the drainage system if and when required is not difficult in that to commence operations all that is required is to dig out the short length of tiles from each outlet.

## Costs.

Detailed costs for the complete mole drainage of the 32-acre area from which the illustrations in this article were obtained are as follows:—

| | £ | s. | d. |
|---|---|---|---|
| Fuel, 42 gallons at 1s. 1d. .. .. .. | 2 | 5 | 6 |
| Oil, 29 hours at 3d. per hour .. .. | 0 | 7 | 3 |
| Wages, 3 men, 29 hours, at 2s. per hour .. | 8 | 14 | 0 |
| Depreciation tractor and plant at 1s. 6d. per hour .. .. .. .. .. | 2 | 3 | 6 |
| Tiles for outlets .. .. .. .. | 0 | 18 | 0 |
| Wages, 2 men, 8 hours, at 2s. per hour (tiling outlets) .. .. .. | 1 | 12 | 0 |
| Total .. .. .. .. | £16 | 0 | 3 |

Cost per acre, 10s.

## Scope of Mole Drainage.

The essential conditions for satisfactory mole drainage are—

(1) A suitable stiff clay subsoil free from obstructions such as ironstone pans, roots, or large stones, which would interfere with the drawing of the mole-drain plough through the soil.

(2) The stiff impervious subsoil must be within 20 in. to 22 in. of the surface, as this is the maximum depth that the usual plough will go.

(3) There must be an appreciable fall in the direction of the mole if the drains are to last.

On flat land or land with little fall mole drains do not last, but are often well worth putting in because of their effectiveness while they last.

There are many thousands of acres of country in the Manawatu, Rangitikei, and southern Hawke's Bay Districts with conditions almost ideal for effective and lasting mole drainage. Fig. 10 is a typical illustration of such country. The free drainage of several inches of dark loam soil is held up by a stiff impervious clay subsoil, the fall is generally good, and suitable places for outlets are easily found. The lower ploughable slopes of much of the steeper hill country in many districts lie wet and cold in the winter because of the stiff subsoils, and the mole plough can be used with good results on such land. In many other districts, particularly in North Auckland and Southland, the stiff clay soils can often be drained and improved by mole drainage and the method described above adopted with advantage.

The mole plough is not effective on relatively loose and open soils where the drainage may be bad on account of a pan formation. Mole drainage, though effective, cannot be made lasting on relatively flat land, such as river flats and swamp land, even where the subsoil may be ideal for the purpose. The fall is not enough to keep the drains cleared of silt, and they rapidly tend to silt up, although the outlets may be kept clear.

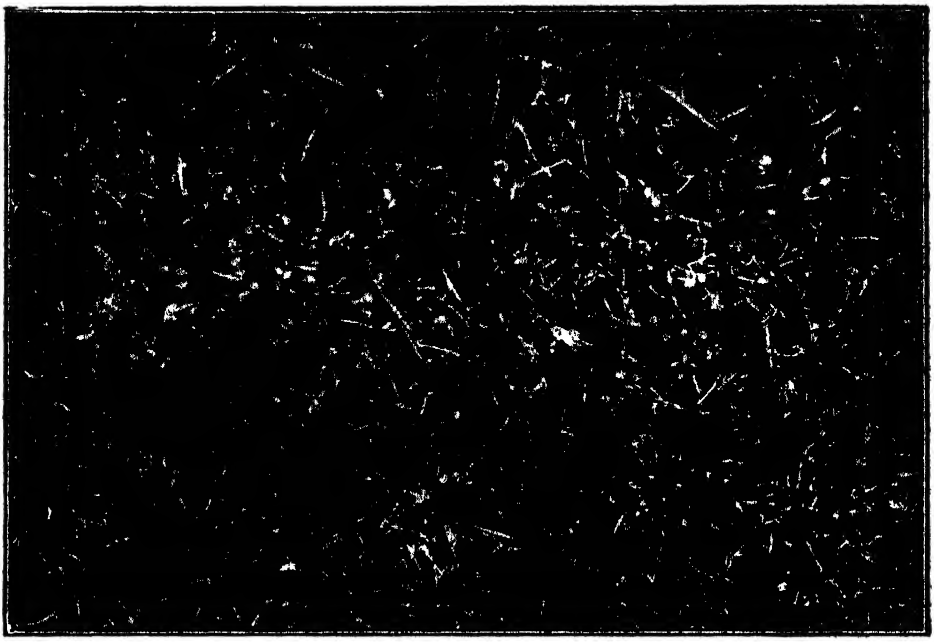


FIG. 10. EFFECT OF MOLE DRAINAGE—CONDITIONS GOOD FOR THRIVING PERENNIAL RYE-GRASS AND WHITE CLOVER.

FIG. 11. PORTION OF MR. MCLEOD'S FARM AFTER EFFICIENT MOLE DRAINAGE SHOWING ABSENCE OF RUSHES AND DENSE SWARD OF RYE AND CLOVER.

If mole drains will last, however, for three to four years, as they often do in land with a slight fall, and can be put in for a few shillings per acre, the effective removal of surface water is well worth while. The renewal of the drains is easily done when a tractor and mole plough working to suitable open drains can do up to 15 to 20 acres per day.

Opinions vary as to the best depth to draw the moles and the best time to do the work, but the following general recommendations are considered sound under average conditions.

### Depth of Drains.

A minimum depth of 12 in. with the plug working at least 2 in. in the clay subsoil is advisable. With mole drains nearer the surface the sides of the drain are likely to crumble rapidly in dry weather. There is also the danger of damage to the drains at soft spots by heavy cattle or by the plough. Mole drains drawn deep in the clay, particularly in stiff impervious clays, are generally ineffective, the water taking too long to pass into the drains. Deep drains, however, last well. In practice, a depth of 14 in. to 18 in., with the mole drains about 3 in. in the subsoil, is found to give good results in rapidity of drainage and in lasting drainage.

### Time to drain.

The best time to do the work is when the subsoil is wet and the surface dry. The dry surface means less cutting about and more effective pulling-power of the tractor. The wet subsoil ensures less draught and good clean mole drains. Suitable conditions seldom occur both in respect of the dry surface soil and wet subsoil until the land is drying out in the spring. September and October are often good months in which to do the work. Mole drains drawn under very wet surface conditions are liable to blockage by soil going down the knife cuts. The results, however, are quick and spectacular, and there is a tendency therefore to do the work under these conditions which are not at all favourable for lasting work.

There are a number of other points regarding mole drainage—the size of plug, speed of the plough, pulling across the steepest slope, not crossing depressions, correct spacing, and many others which should be considered. A 2½ in. to 3 in. plug is generally used, and this size of plug is suitable to most conditions. The stiffer and stickier the soil the smaller the plug, and *vice versa.*

The best speed for the plough is about two miles and a half to three miles per hour. Fast work is not desirable, as the drain-sides tend to be drawn in, and in somewhat dry soils will flake.

Although it is held that the mole drain lasts better if drawn away from the outlet and up the slope, this is not essential to good work. Permanent outlets and the provision of sufficient pressure in the stream of water down the moles is considered of far greater importance, and also the saving of time when the plough is kept in the ground continually.

Depressions should not be crossed, as silt is liable to collect in the depressions in the drains and cause blockages. The modern type

of light mole plough can be used to cross narrow finishes and fearings, as the general depth of the mole drain is not affected in crossing these (Fig. 11). An effective spacing in most soils is about 9 ft., but on very wet, stiff soils the moles should be as close as 6 ft. Mole drains should be close together when running down the grade and wider apart across the fall or steeper slopes.

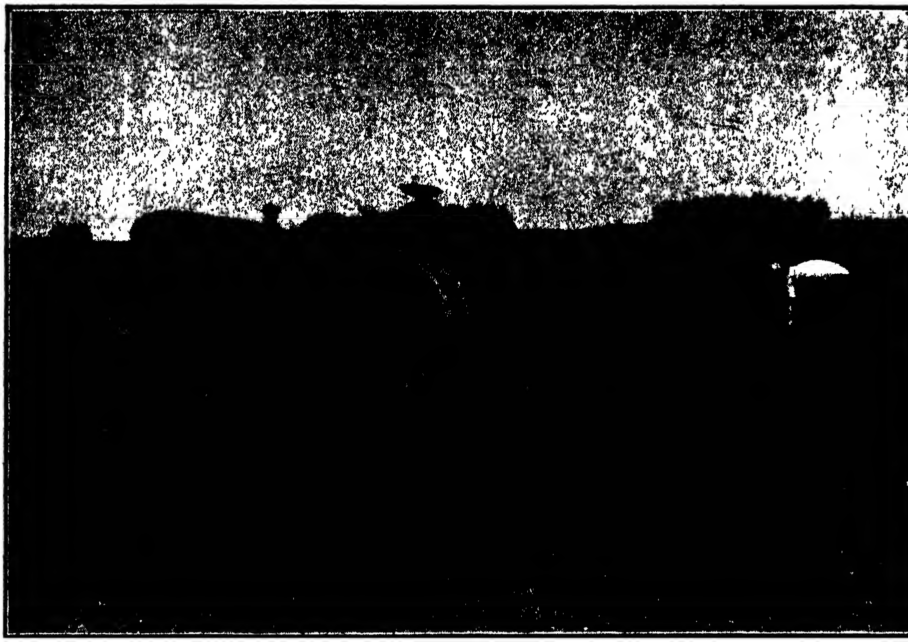


FIG. 12. THE LIGHT, EASILY ADJUSTED TYPE OF MOLE PLOUGH FAVOURED IN THE MANAWATU DISTRICT.

## Conclusion.

The method of mole drainage described in this article is confidently recommended to those practising mole drainage under similar conditions, and farmers are further recommended to consider the possibilities of the mole plough where good drainage is required.

The writers wish to record their thanks to Mr. McLeod for making available the practical details of his methods, and also to the official photographer, Mr. Harvey Drake, who is responsible for the illustrations.

The importance of surface-sowing subterranean clover at the most suitable time has been well shown in the Manawatu district in the past season. Areas sown in early February appear much further ahead, both in number of plants germinating and also in their vigorous growth, than areas sown later in the autumn. This year, owing to the high summer rainfall, subterranean clover could be sown much earlier than usual with good results, and those that took the opportunity appear to have been well repaid.

# SEASONAL NOTES.

## THE FARM.

### A Cause of Poor Results from Top-dressing in Lamb-production.

RECENT official statistics show that last year's record number of breeding-ewes in the Dominion has been exceeded this year. This new record number of breeding-ewes probably is, and certainly might fittingly be, connected with the evidence from sales of fertilizers that increased top-dressing of grassland has been carried out in the sheep-farming of at least several districts; there is much farm experience indicating that judicious top-dressing of suitable pastures can be made a direct and profitable means of producing greater numbers of better lambs. Such experience continues to become available in increasing volume not only from districts of more than 30 in. of annual rainfall, but also from ones of considerably less rainfall.

While the general position is that top-dressing has been found of value in producing a bigger and more profitable crop of lambs, it is desirable to bear in mind, especially at this season of the year, that farmers are to be found in both the North Island and the South Island who, on the basis of personal experience, state unhesitatingly that top-dressing has been associated with poor results in the production of lambs. Close scrutiny of their experience often has certainly confirmed their statements, but at the same time has provided an explanation of the poor results. It is of great practical importance that this explanation has in no respect affected the general validity of the fact that over wide areas top-dressing may be employed to increase the output and the net returns in lamb-production.

In short, top-dressing has been linked with exceptionally good results and quite poor results in lamb-production, and this in the one district under similar conditions of soil climate and original pasture-covering and with the same type of top-dressing material used when the results were both good and bad. This somewhat paradoxical position arises primarily from the fact that using fertilizer on grassland and using the results from fertilizer on grassland are two totally different matters; or, expressed in other words, it is of great practical importance to distinguish between applying fertilizer and using fertilizer on grassland having in mind that, according to the dictionary, "use" means "application to a purpose." In farming, and especially in sheep-farming at times, the application of fertilizers to pastures has been judicious, while later on the use of the results of the fertilizers has not been judicious.

The crux of the position is given pithily in the following statement of Dr. Fraser of Rowett Institute:—

"Ewes and lambs will never thrive on stemmy pastures . . . I have repeatedly noticed how lambs go off when grass shoots and clover flowers."

This statement introduces no new idea: it merely emphasizes a fact that is demonstrated throughout a countryside whenever that countryside enjoys weather that favours unusually rapid growth of pastures in spring and early summer and the sheep-farmers do not take adequate measures to cope with the surplus feed that results. Judicious top-dressing begets additional feed just as favourable weather conditions may beget additional feed: either top-dressing or favourable spring and early summer weather may lead to poor results with lambs unless the surplus feed is handled in such a way that stemmy pastures for the ewes and lambs are avoided.

Phosphatic top-dressing when it is effective, as it so commonly is, intensifies the superabundance of feed directly available from grassland in

the late spring and early summer. Hence if top-dressing is not followed by measures for dealing with an increased supply of feed at this period, then usually and almost necessarily a stemmy condition of the pastures develops about November, and, stemmy pastures being eminently unsuitable for ewes and lambs, sheep that were thriving up to the appearance of stemminess in the feed soon cease to thrive.

From this it follows that as a rule the man who condemns top-dressing as a factor in profitable lamb-production has to face one of the following alternatives: Either his top-dressing has not been suitable to his conditions and has not produced enough additional feed to become profitable or the top-dressing has been effective enough and there has been failure in some other phase of the management of the farm so that the additional feed has not been used properly. In either case the poor result originates in poor management.

### A Parallel Position in Dairying.

When the weather in spring and early summer has favoured rapid growth of pasture not infrequently the production of herds begins to fall in November or early December at a rate which is greater than is natural in satisfactory dairy stock being fed efficiently. Such an abnormal falling-off in production is almost always if not always, associated with the development of stemminess in the pastures. Stemmy pastures intrinsically are unsuitable for the feeding of cows of reasonably good productive capacity because heavy production is possible only in animals receiving a liberal supply of feed of high digestibility and the digestibility of the feed from pastures is greatly impaired as their stemminess due to an increased content of fibre increases. About 80 per cent. of the dry matter of leafy pasture-growth is digestible, whereas only from 40 per cent. to 60 per cent. of the dry matter of stemmy growth is digestible. Hence a given weight of the dry matter of stemmy growth may be only half as nutritious as the same weight of the dry matter of leafy growth and readily may provide inadequate nutriment for dairy cows over and above that required for mere maintenance to enable full productive capacity to be exercised.

Especially may poor results be expected in the case of pigs supporting themselves mainly on stemmy pastures; actually some of the poor results recorded from summer grazing of pigs may be attributed definitely to the stemminess of the pasture to which they had access. The ready way in which pigs react unfavourably to stemminess in pastures is due primarily to the fact that pigs are less fitted naturally to utilize feeds of low digestibility than are cattle and sheep—in the pig the volume of alimentary canal, in which digestion takes place, per 100 lb. of live-weight is much less than in cattle and sheep. Largely because of the comparatively restricted capacity of its alimentary canal or food tract the pig cannot utilize economically feeds of high fibre content; in this connection it is instructive to contrast coarse pasture growth having 20 per cent. of fibre in its dry matter with skim-milk from which fibre is absent and leafy pasture growth having approximately 10 per cent. of fibre in its dry matter.

### Importance of Summer Control of Pastures.

The above considerations point unquestionably to a past common weakness in the management of pastures due to the fact that but little attention has been paid to the influence of the mechanical character of feed on the response of the animal when in feeding; this is actually of primary moment. A fact which obtrudes itself in practice is that in assessing the nutritive value of feeds for live-stock attention must be given not only to such matters as chemical constitution, vitamins, and minerals, but also to the physical or mechanical constitution of the feed. The extent to which the latter has been overlooked in our grass-farming has been very detrimental to returns; every pasture in which flowering stalks are prominent in

summer is an instance in which the feed has deteriorated from the mechanical aspect of nutrition—its fibre content has increased and its digestibility has decreased correspondingly.

How to avoid stemmy pasture is a question which must be dealt with during the next few weeks. In dairying the measures that widely have proved decidedly valuable to this end are (1) suitable systematic grazing management; (2) adequate saving of silage and hay; and (3) topping of pastures with the mower.

Suitable systematic grazing is not at all difficult to carry out as may be gleaned from the fact that the essential steps in quite effective grazing on many farms have been :—

(1) Rapid grazing of fields by relatively heavy stocking. Stocking at the rate of from six cows an acre upwards for periods of from one to three days has in practice given excellent results. The tendency definitely is for the best results to come from periods of only one day's grazing, which necessarily call for greater frequency in grazing than is advisable when the grazing-periods are of longer duration.

(2) Subsequent complete spelling of the pastures to allow of recovery sufficient to give the amount of grazing already specified. According to the rapidity of the pasture-growth spells of from about seven to fourteen days' duration have given good results.

Really close grazing of the pastures is at no stage necessary; in fact, it is undesirable. Hence suitable systematic grazing does not call for punishing treatment of either the pastures or the stock. Splendid results are being obtained on many farms on which nine to twelve paddocks are under grazing.

A most important aid to good results in systematic grazing is the immediate elimination, as far as is possible safely, from the grazing programme of all grassland additional to that needed to meet the current feed requirements of the stock. Frequently poor results originate in failure to attend to this. The rational course is to save the feed from the fields dropped out of the grazing programme as silage or hay. A steady improvement in the Dominion in this matter is indicated by official returns which show that 536,000 acres were used for hay and silage in 1935–36, in comparison with 251,000 acres in 1927–28. A puzzling feature of the position is the decline in the ensilage acreage from a peak figure of 116,000 acres in 1932–33 to 83,000 acres in 1935–36. As a pasture-management measure ensilage is of outstanding value because it enables the disadvantages attaching to haymaking on account of unfavourable weather to be eliminated altogether. It is of prime importance to mow fields for hay or silage during the short period in which they are at the best stage of development having regard to the future production of the pasture and the feeding-value of the hay or silage. In ensilage, the farmer is independent of the weather; hence he may mow at exactly the best stage knowing that he can save the crop in good condition irrespective of the subsequent weather and that because of suitably early mowing he later will be rewarded with leafy aftermath which is likely to be especially valuable at just the stage when it becomes available and which almost certainly would not be produced at the time it is most needed following mowing delayed until the weather is good for haymaking. In short, efficiency in the matter under consideration depends basically upon the job being done at the right stage: ensilage enables the crop to be saved at the right stage without suffering otherwise in quality.

It being difficult to gauge exactly the area of grass needed to meet the feed requirements of the stock often some surplus feed arises in early summer on the paddocks not closed for hay or silage. Usually there is not enough of this feed to enable it to be conserved satisfactorily, but

enough of it, if it is not dealt with, to spoil the control of the pasture-growth. When this is so it is as a rule advisable to check the development of coarse stemmy parts in a field by "topping" of the pastures—*i.e.*, by mowing to remove flower-heads. In this the mower should be set high. Close-mowing if followed by droughty conditions may lead to drying of the pasture and so have a decidedly undesirable result; in addition, it wastes feed. Frequently topping is deferred until it is so late that it is possible to obtain only little, if any, benefit from it. The primary objective in topping is the removal of flower-stalks and coarse growth, and the sooner these are removed after their development the better is the result.

Up to the present the three practices just discussed—systematic grazing, ensilage, and topping—have been employed with success most commonly on dairy-farms. Some farmers, however, have employed them with outstanding success on sheep-farms, and thereby demonstrated that on many sheep-farms, though certainly not on all, more could be done, and this with attractive profit, than is being done to secure such control of the growth of pastures during the early summer as would result in less stemmy and more digestible feed for ewes and lambs.

**The Mangel.**

Judging from advice to hand regarding sales of seed last year, there was an appreciable decline in the Dominion acreage of mangels. In some instances farmers may have been justified in reducing the area devoted to mangels or even in dropping the crop from their programme of feed provision, but in general an increase instead of a decrease in the Dominion acreage of mangels would be distinctly profitable. While exact comparisons between feeds so different in character cannot be carried very far with safety it is interesting to note that on the basis of their nutritive value mangels are worth about £1 a ton when compared with pollard at the present price in the North Island. Yields of 60 tons and over of mangels an acre are quite frequently obtained. The mangel is especially reliable, because it is subject to no serious disease or pest, and because when it receives reasonably good treatment it is able to stand a dry period comparatively well. The variety Prizewinner Yellow Globe is more widely grown than any other, this being the result largely of the consistently good yields of this variety which have been recorded over a long period. Other varieties of known good value are Red Intermediate, White Sugar, and Jersey Queen. The standard practice continues to be to sow about 6 lb. of seed an acre in rows 26 in. to 28 in. apart. There is a limited amount of field evidence which points to the practicability of obtaining greater yields by sowing in rows closer together (*e.g.*, 20 in. to 22 in. apart) and using heavier seedings (*e.g.*, 8 lb. an acre), but the amount of this type of evidence available, while suggestive, is not conclusive. Cold, wet conditions tend to cause loss or stunting of seedlings, and therefore sowing should not be done before warm conditions in the soil may be expected; over wide areas sowing before November is not advisable.

The mangel responds profitably to preparatory cultivation, which brings about a fine, firm seed-bed, and the best and cheapest way of obtaining such a seed-bed is to begin the job well ahead of seed-sowing.

The manurial needs of the mangel vary with soil and climatic conditions, but field results have shown that as a rule good returns may be expected from the use of a dressing of 5 cwt. to 6 cwt. an acre of a mixture consisting of equal parts of superphosphate and blood and bone or three parts of superphosphate to two parts of blood and bone. In districts in which benefit has been obtained from the use of potassic fertilizers the use of 2 cwt. to 3 cwt. of kainit an acre is likely to prove profitable.

Good treatment for the mangel in respect to both cultivation and fertility is specially advisable, and if the probability of giving the crop good treatment seems small, then another less exacting crop such as swedes or chou

moellier should be grown. But the mangel responds so strikingly and profitably to good treatment that it should be grown much more widely whenever it is possible to meet its needs. Because of the really heavy yields of which it is capable it is especially suitable on costly land—it enables the heavy fixed charge of rent or interest on the land to be more widely spread.

### Causes of Inefficient Ensilage.

Unfortunately, a good deal of inefficiency characterizes ensilage in New Zealand. In addition to failure to utilize up-to-date labour-saving equipment and means of storage—*e.g.*, trenches and pits—among the main causes of inefficient ensilage are :—

(1) Too late mowing of the crop, which, as a rule, leads to a falling-off in quality that substantially outweighs any increase in quantity. The material resulting from too late mowing is unduly stemmy or woody, and this, irrespective of the curing process, is associated with the poor balance in the supply of nutriment and the low digestibility that characterizes any over-mature pasture-growth.

(2) Curing at excessively high temperatures, which results in avoidable loss in feeding-value. This often may be remedied by more speedy ensilage. Partial wilting of the material tends to lead to high temperatures, but in dealing with very sappy material partial wilting may be advisable. As a rule, additional green material should be placed upon that already gathered as soon as the latter begins to sink in height because of the curing process. If this rule is followed temperatures in the vicinity of 100° F. will develop and silage of a greenish to a yellowish tint usually will result.

(3) Insufficient exclusion of air, which leads both to too high temperatures, resulting in silage which is too dark and in wastage due to decay. This fault may be removed or lessened by more thorough packing in the pit or trench and by more adequate covering of earth or other sealing-matter, which, to minimize wastage, should usually be placed in position practically as soon as all the green material has been gathered. It is more difficult to exclude air sufficiently from stemmy than from leafy green material, and because of this late mowing tends to less efficient curing and more wastage.

—*R. P. Connell, Land Utilization Officer.*

# THE ORCHARD.

### Pest and Disease Control.

THE effective control of pests and diseases in the orchard will be the chief concern of orchardists for the next month or so, and it will be necessary to be on the watch for the first appearance of disease, so that early and appropriate measures may be taken. Showery weather, with warm spells intervening, is usually experienced at this period of the year, making it more difficult for the orchardist to apply the respective sprays at the proper times. It should also be remembered that such weather is favourable for the spread of fungous diseases, and at the same time insect pests will also be on the increase. Of the fungous diseases, black-spot is probably the chief consideration in most orchards. Growers should anticipate an attack rather than wait until the disease makes its appearance on foliage and/or fruit—to obtain success the treatment must be preventative and not curative.

The advice given in the last month's notes in the *Journal* should be carried out as far as climatic conditions will permit. Should rain follow before the spray has had a chance to dry on the trees it will be necessary to repeat the operation as soon as possible to replace the protective film of spray. From now on growers will be using specifics in combination when applying sprays, and care must be exercised to avoid damage being done to either

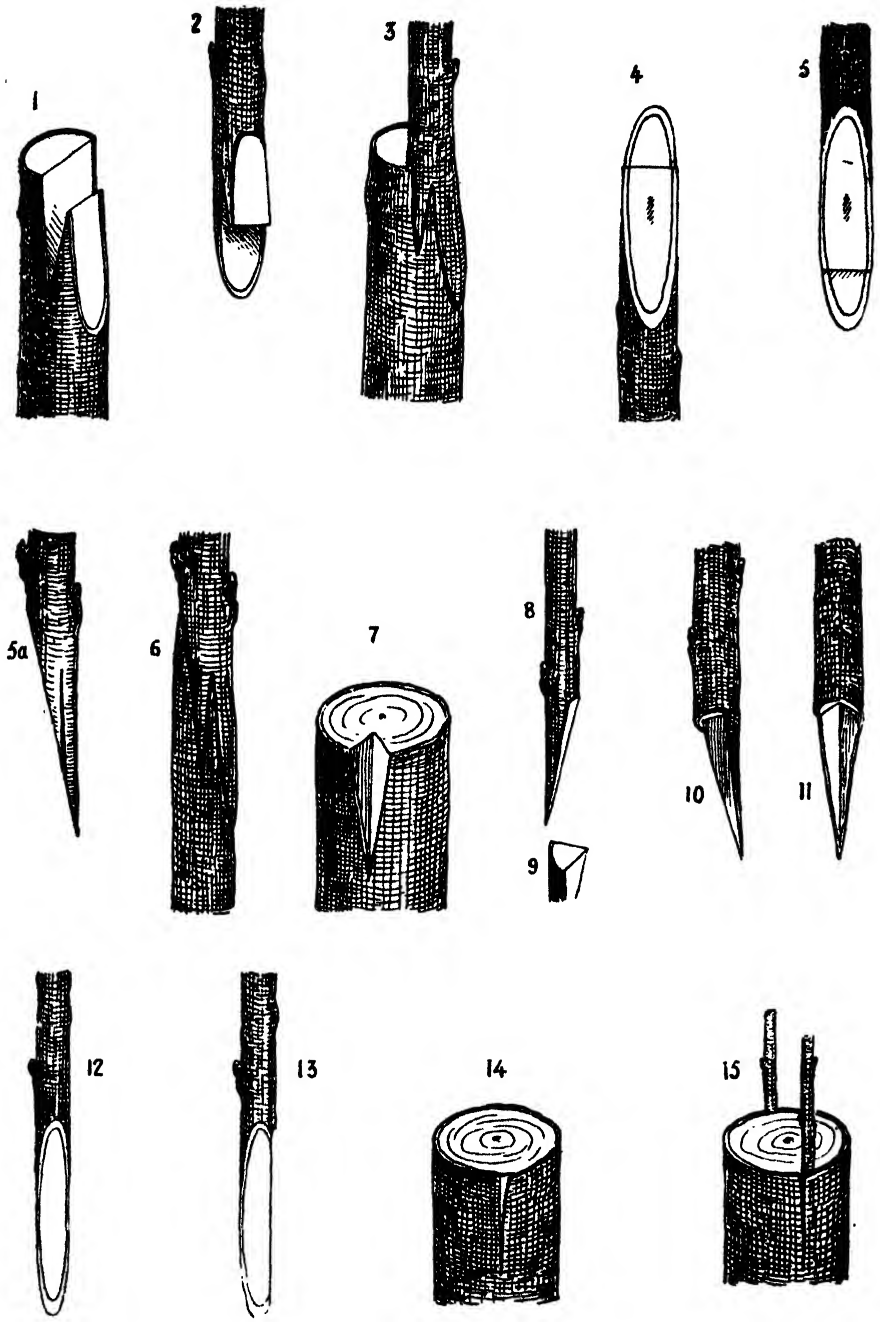
foliage or fruit. While the application of sprays usually costs more than the materials used, and the combining of two or more sprays is an advantage, three factors should be kept in view—(1) disease-control, (2) injury to tree, and (3) russeting of the fruit. On some of the tender-skinned varieties the use of colloidal-sulphur in place of lime-sulphur is recommended after the " petal-fall " period, but growers will have to be guided in their choice of these specifics by weather-conditions ruling at the time. Tests carried out with lime-sulphur at strength, 1 per cent. polysulphide content (1/150), plus colloidal-sulphur at 2 lb. per 100 gallons of spray, have proved very effective for the control of black-spot; in fact, in many cases the results have been better than where lime-sulphur was used alone, and the risk of russeting the fruit has been minimized. There appears to be very little advantage in using a spreader in sprays to which colloidal-sulphur has been added. Where there is a risk of damage to foliage or fruit from the use of lime-sulphur during the early summer period it is preferable to switch over to the combination or even use colloidal-sulphur alone. Whichever spray, or sprays, it is decided to use, the closest attention should be given to thoroughness of application, correct measurement of ingredients, and complete coverage. It is only by attention to these matters that an effective control may be secured.

### Cultivation.

The continuation of the cultivation of the orchard should not be neglected, as it is only by repeated stirring with either harrow or cultivator that the soil can be reduced to that fine state so necessary to produce a satisfactory soil-mulch. Hoeing round the trees, if it has not already been attended to, should receive attention before the soil becomes too hard. This orchard practice is not only very beneficial to the trees, but is the means of destroying any volunteer growth and trash which provides a good breeding-place for pests and diseases. Light cultivation by means of disks, scarifier, or other means at convenient intervals throughout the season has a great influence on the quality of both foliage and fruit and should therefore receive the attention due to it.

### Grafting.

During the past two or three years an increased number of apple-trees have been reworked to other varieties. It is still being carried on extensively, as growers have come to realize that it is not profitable to grow varieties that do not even pay ground-rent. The question of which varieties to work is an important one, consideration having to be given as to whether the new variety is required for the export or for the local market trade. Some consideration should also be given to varieties already grown in the orchard, whether early or late, dessert, or cooking, coloured or green, susceptibility to disease, &c., and whether the resultant crops are likely to find a ready market. The tendency should be to decrease the number of varieties grown rather than increase them. Therefore before starting grafting operations full consideration should be given to these points; it may save disappointment in the future. Grafting is not a difficult task, although several points have to be kept in mind. Even with the greatest care it is not always possible to get 100 per cent. take, especially if the scions have not been kept in a dormant condition or the buds are in an unhealthy state. Some growers have been inclined to leave the grafting until the weather becomes hot and dry, and then wonder why " the take " has not been up to expectations. Accuracy in cutting, both scion and stock, has a great influence on the results obtained, whilst neatness of work should be the aim of the operator. If these important details are attended to, the union between stock and scion will soon take place, and then the buds on the scion will break into growth. The method usually employed is known as " bark " or " rind " grafting, although on occasions, if the stock




GRAFTS.

1, 2, 3. Whip graft for use when stock is thicker than scion.
4, 5, 5a, 6. Whip graft for use when stock and scion are equal in thickness.
7, 8, 9. Notch graft: scion for old trees, and section of scion.
10. Improved notch scion with shoulder.
11. Front view of No. 10.
12, 13, 14, 15. Rind graft (Fig. 13 showing scion with square edge).

is not too thick, the "whip" graft may be used; but, whichever method is adopted, it is imperative that the fit be perfect as possible, and that the scions be securely attached to the stock, either by means of a small tack or by tying with raffia. The whole of the cut surface must be thoroughly waxed, either with a home-made grafting-wax or with one of the proprietary compounds which are now available on the market. The thorough covering is most important, and should not be neglected, as exposed surfaces offer ready entrance for disease.

The reworking of fruit-trees by the introduction of grafts along the branches, instead of the older method of cutting the tree down to clear the base of the limbs and then grafting, has gained a certain amount of favour recently. There are many points in its favour, although it is a long and tedious operation, and therefore more costly. When one considers that as many as 150 grafts might be inserted along the branches of one tree, the time taken to graft an acre or two would be great. One of the chief advantages with the "porcupine" system is that a full-bearing tree is obtained sooner. Whether this compensates for the extra time taken is questionable. By this method leaders not required in the future tree are cut out, the balance being bared of growth with the exception of any side laterals suitable for grafting. The branches are cut down to the required height and grafts are inserted at regular intervals, taking advantage of any side laterals in a convenient position. A graft is also inserted in the top of each of the leaders. The whole of the cut surfaces are covered with grafting-wax. During the growing season many laterals will grow from the original tree. These can be utilized by inserting buds in February should any of the scions fail to grow, otherwise they must be suppressed.

### Fireblight.

Growers are advised to keep a sharp look out for fireblight infection. The disease may be discerned by the discoloration of the blossoms which continue to hang on the trees and by the sudden wilting of new shoot growth. It is mainly through the blossom that the disease spreads to the growing tips of the laterals, and then down the laterals to the main branches. The spread of the disease may be very rapid, enveloping the whole tree if uncontrolled. All affected parts should be cut out below the visible point of infection and destroyed immediately. The secateurs should be sterilized with formal-alchol (commercial formalin 6 cc., alcohol 95 per cent., methylated spirit 94 cc.) after every operation. Any suspected specimens should be submitted to the Orchard Instructor for the district for examination.

The wounds should be treated with acidulated mercuric chloride solution (mercuric chloride 1 gram, hydrochloric acid concentrated 15 cc., water 500 cc.). The solution should be held in glass or earthenware container. It is highly poisonous and should be labelled conspicuously "POISON." It should not be left lying about.

—*George Stratford, Orchard Instructor, Motueka.*

### Citrus Culture.

*Pruning.*—Citrus trees can be pruned at any time of the year except during their winter period, but the most suitable time is in the spring, when the danger of further severe frosts is past. There is no fixed style of pruning for citrus trees that can be claimed to be generally suitable for adoption in all orchards nor for any individual orchard, as every orchard and every tree has its particular requirements in the way of pruning. The need for this variation of treatment is much greater in citrus than in any other class of fruit-trees. The pruning, however, should be sufficient to maintain a fairly open-headed tree furnished with a good supply of thrifty fruiting-laterals. A systematic pruning at the time of planting is, however, of the utmost importance. Trees should then be pruned in much

the same manner as deciduous fruit-trees, from three to four branches being selected to form the framework. The branches should be arranged spirally on the trunk and not opposite each other. The lowest branch should be at least 2 ft. from the ground. All branches that are not required should be removed. These framework branches need not be shortened provided they are of equal vigour, have not been injured by frost or other causes, and are not exceptionally long. During the following three years frequent light prunings are necessary, particularly for the purpose of removing superfluous shoots and crossing branches. Any branches which are growing vigorously to the detriment of others should be frequently pinched back to give the tree a balanced head.

In later years much greater variation in the treatment of individual trees is necessary. It is not possible in these notes to describe all of these treatments. Probably the three most important aspects of pruning mature trees are—(1) the maintaining of a fairly open head, (2) the reinvigorating of fruiting-laterals, limbs, and even entire trees that show signs of lacking full vigour, and (3) the removal of all dead wood. The degree of severity with which to prune must vary, according to circumstances, from a removal of spent fruiting-laterals, as is frequently found in the interior of lemon-trees, a shortening-back of branches and strong lateral growths to cause them to send out fruiting wood nearer their base, to a complete skeletonizing of the entire tree in cases of extreme debilitation. It is also important that shoot-growth killed by frost should be removed as soon as the danger of further frosts is past. All cuts more than ½ in. in diameter made in pruning should be covered with a wound-dressing of the bitumen-emulsion type.

*Manuring.*—If the spring dressings of fertilizers and manures have not yet been applied, this work should be put in hand as early as possible, as it is now becoming late for such applications. Where available, farmyard manure of any kind should be given preference, and this can be supplemented by a quick-acting nitrogenous fertilizer such as sulphate of ammonia. Annual dressings of blood-and-bone manure at the rate of 8 lb. to 12 lb. per tree is giving good results.

*Budding.*—If it is intended to rework citrus trees the budding should be proceeded with as early as possible to ensure satisfactory growth during the current season. In selecting budwood it is important that only well-matured wood should be used. Plump shoots of the type that usually produce fruit give the best results. Flat or angular growth is undesirable. Different types of citrus budwood are shown in the accompanying illustration.

*Verucosis.*—In some instances growers do not appear to realize that the rough condition of the rind of their fruit is due to this disease. The fruit is most susceptible to infection about the time the first blossoms are shedding and while the fruit is quite small. The most dangerous period for infection is when the fruit of the main crop is setting. In orchards where the disease has become established three applications of Bordeaux-mixture spray at a strength of 3-4-50 are recommended as follows: (1) When the earliest fruits of the main crop are setting; (2) Repeat three to four weeks later—this repeat spray is very necessary; (3) a spraying during the autumn blossoming-period is also required to ensure a clean crop. Where black aphis or scale insects are troublesome it is good practice to add summer-oil at a dilution of 1–1000 to the Bordeaux sprays. Where black aphis is the only insect troublesome at the time, nicotine sulphate, 40 per cent., can be used in the place of summer-oil at a dilution of 1–800.

*Cultivation.*—The surface soil should receive cultivation sufficiently frequently, for the next few months at least, to prevent a crust forming

on the surface of the soil and to retard the growth of weeds. There is a tendency on the part of many growers to cultivate to a depth of 8 in. to 10 in., particularly on the light pumice soils. This practice of deep cultivation is believed to be responsible for the general unhealthy

DIFFERENT TYPES OF ORANGE BUDWOOD.

On left, old and blind type; two in centre, flat and angular type; two on right, desirable type.

appearance of many citrus orchards. A tilth of from 3 in. to 5 in. is all that is required in most types of soil, and deeper cultivation is liable to destroy valuable feeding-roots without offering any advantage.

—*P. Everett, Orchard Instructor, Gisborne.*

# POULTRY-KEEPING.

## Preserving of Eggs.

ALTHOUGH much has been accomplished during recent years by improved methods of poultry-keeping to bring about a greater production of fresh eggs during the winter months, it may still be said that eggs are a seasonal product.

The average monthly production of a good flock of first-year leghorns should be in the vicinity of the following: April, 22 per cent.; May, 51 per cent.; June, 52 per cent.; July, 58 per cent.; August, 65 per cent.; September, 74 per cent.; October, 75 per cent.; November, 68 per cent.; December, 64 per cent.; January, 56 per cent.; February, 55 per cent.; March, 32 per cent. Owing to this uneven seasonal production, which results in a surplus during the spring months and a shortage during the late autumn and winter months, it is an economic proposition to preserve eggs during the flush season for use during the off periods. September, October, and November are the months of greatest production, and eggs naturally cost less to the consumer then than at any other time of the year, and a good saving may be effected in the home if householders preserve eggs when cheap for use during the scarce and dear season. Apart from the fact that eggs are cheaper, the spring and early summer are the best times to preserve, for, generally speaking, eggs produced at these times are of better quality and possess better keeping-qualities than those produced during the hot weather.

Those intending to preserve should lose no time placing down their requirements. Only fresh, clean, and sound-shelled eggs should be preserved, as one or two dirty, cracked, or musty eggs may spoil the lot. For this reason all eggs should be tested for cracks and internal quality before being placed in preservatives.

To test for cracks take an egg in each hand and gently tap them together; if the shells are sound they will give a true ring, but if one is cracked the sound will be dull and quite different.

Examination for internal quality can be made by the use of a tester and by holding the eggs to a strong light. By this method any defects can be detected at once. A simple tester can be made from heavy brown paper, such as illustrated on page 52 of the Department's Bulletin No. 66, "Utility Poultry Keeping," a copy of which may be obtained from the Publisher, Department of Agriculture, Wellington, at a cost of 1s., postage free.

It is advisable to allow the animal-heat to get out of eggs before they are placed in solution; as an instance, eggs laid to-day would be better if kept in a cool place for about twenty-four hours before being placed in preservatives. Thoroughly clean jars, crocks, or tins should be used to preserve eggs in, and these vessels should be kept in a cool dry room with plenty of ventilation.

There are several useful mixtures and brands of preservatives on the market. Some householders put eggs down in dry salt or even bran. A lime-water solution is sometimes used, made up of 4 measures of fresh, finely slaked lime mixed with 20 parts of water and 1 measure of salt. The whole is well stirred together a day or two before using; the clear liquid is then poured off and the eggs placed in it. A more popular preservative and one used with almost universal success is water-glass (silicate of soda); this material is sold by most chemists and grocers for the purpose. The water-glass should be diluted just enough to allow the egg to sink, say, from ten to fifteen parts of water to one of water-glass according to its strength. The water should be boiled and allowed to cool before mixing in the water-glass. Eggs may be added from time to time until the vessel is full, but at least an inch of the solution should cover the top layer of eggs. When the vessels are full they should be covered over in order to prevent evaporation of the solution.

Eggs should be washed when taken from the preservative and if they are to be boiled it is advisable to prick the thick end, otherwise expansion is likely to cause them to crack.

### October Brooding.

October-hatched chickens are, as a rule, much more difficult to rear artificially than those hatched earlier. Especially is this so if the weather is warm and muggy nights are experienced.

Efficient management and close attention to all little details is required to make a success of the later-hatched chickens. It frequently happens that the poultry-farmer has so much to do at this time that he is unable to give that extra time to the last batch of chickens, which often means so much for their welfare.

The chief essentials to successful artificial brooding are proper warmth, a constant supply of fresh air, ample room under the hover, dryness, and cleanliness. Poultrymen of experience seldom use a thermometer when brooding chicks as they depend upon the action of the birds to indicate whether the correct temperature is being applied. There is with some a tendency to use the same amount of power or flame during October as previously used during the colder months, resulting in the chicks being compelled to sleep in an overheated atmosphere, and consequently they do not thrive. Where the beginner is not satisfied with the progress being made by his chickens he would be wise to place a thermometer under the hover about an hour after the brood has camped for the night, and the cause, or one of the causes, of unthriftiness may be detected.

The trouble known to poultrymen as "green-leg" or "green-wing," the chief symptoms being a swelling of the head, neck, and hock joints, often makes its appearance about this time of the year. It is really the result of incorrect night conditions such as overcrowding of the brooder, lack of proper ventilation causing the chicks to breathe the impure air, a condition which also causes the bedding to become damp when a moist atmosphere is created. Treatment for this trouble is of little avail; it is more a matter of prevention.

If a frame is not used to brood the chicks in, as recommended in Bulletin No. 66, "Utility Poultry Keeping," one should be installed. When a frame is in use care must be taken to see that the netting or sacks are tight so that no pockets or hollows are created to encourage the chicks to huddle together; plenty of dry, clean bedding-material should be provided, as a little extra depth of bedding will often help to prevent huddling. Visit the chicks just as they are camping for the night and see that they do not cluster together. If they show a tendency that way they should be gently spread out, and it is advisable to stay and watch them until they have settled down for the night. When the canopy type of brooder is used it is a good idea to very gently lift the hover a little, after the birds have settled down. Above all, avoid overcrowding; in fact, place fewer chicks together as the weather becomes warmer. The cockerels should be picked out as soon as possible and allow the extra room for the pullets.

Well-brooded Leghorn chicks should be ready for perching between six and seven weeks old, but they should be hardened off gradually. It is well to make sure that plenty of trough-feeding space is available so that all birds can feed at once.

### Green Foods.

It is true that chickens and fowls may be kept without green food, but there is a big difference between those that are given a regular supply and those that are not. Green food seems to put new life into the stock, but it should be fed regularly, at least twice a day to chickens and at regular times, otherwise they are likely to gorge. Provision should now be made for a regular supply of green food for the coming months, as no poultry-farmer can afford to be without a good, green food-patch for his birds.

### Chick-sexing Examination.

A chick-sexing examination was held at the Wallaceville Poultry Station on Thursday, 26th August. Six candidates presented themselves for examination, one for a first-class certificate, two for renewals of their second-class certificates, and three for second-class certificates.

Mr. W. H. Barnes, who sexed 50 chickens in ten minutes, with an accuracy of 96 per cent., qualified to have his second-class certificate, which he gained on the 4th November, 1935, renewed.

Mr. J. C. Jamieson, who sat for a first-class certificate, but failed to qualify, sexed 200 chickens in twenty-five minutes with an accuracy of 92½ per cent. His second-class certificate, which he gained on 27th August, 1936, will be suitably endorsed.

The idea of the endorsement of an existing certificate is to show that the person concerned is in practice and able to operate with a good degree of proficiency.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

## THE APIARY.

### Food-supply.

In districts devoid of native bush, where the bees are practically dependent on the flora found in the open paddock, it will be necessary to keep an eye on the food-supply during November. Willows, dandelion, and fruit-trees will have ceased to bloom, and while there will be a little clover in flower this is not likely to secrete nectar. Clover is very susceptible to climatic conditions, and the right conditions for its secretion of nectar do not usually prevail until the end of November or early in December. Hawk-weed and cape-weed will then be in full bloom, so in districts favoured with abundance of this flora there should be a good flow about the time stated. In the meantime care should be taken that the bees are not allowed to starve—it is a critical stage in the life of the colony.

### Swarming.

Given reasonably fine weather some colonies will have become very strong and, unless steps have been taken to prevent it, overcrowded and inclined to swarm. It is best to keep down swarming as much as possible, and to make any increase desired in anticipation of the natural tendency. If no increase is desired, the simplest way to keep down swarming is to provide the bees with plenty of room and offer them inducement to avail themselves of it. This is best accomplished by giving them a super containing, for preference, nine combs—assuming that it is a ten-frame hive we are dealing with—the centre comb being a frame of brood lifted from the brood chamber and replaced by an empty comb. It is not sufficient to merely place the super of empty combs over the brood-chamber; the frame of brood must be lifted and placed in its centre. Where half-depth supers are used this is not practicable; in such cases it is advisable to make a practice of carrying over some partially filled combs from year to year. Even when it is intended to produce section honey it is best to draw the bees first into a super of ordinary combs. When the bees have become accustomed to working in the super it can be removed and a rack of sections substituted.

Despite every precaution, however, the bees will sometimes swarm. It will not be a very serious set-back to the apiary if a few colonies do each cast one swarm, but after-swarms must be prevented as far as possible. The first swarm will be headed by the old queen, and will, given fine weather, come off as soon as the first queen-cell is sealed. Swarms, especially those headed by a laying queen, almost invariably settle within

a few minutes close to the apiary. It is not safe to reckon on the bees remaining long at their first resting-place, however, especially if this is a sunny situation; they may rise again within ten minutes and fly for miles before again settling.

To take the swarm procure a benzene-case or similar box and hold under. If the bees have settled on the branch of a tree shake them with a vigorous jerk of the branch into the box; when this is not practicable brush them in. Then as quickly as possible slip a bag over the box and turn it upside down, placing a stick or stone under one corner to provide an opening for the bees. Leave the bees in this box until at least 4 o'clock in the afternoon, then take them to the site of the prepared hive and, after placing a sack on the ground, shake out the bees immediately in front of the hive. In dealing with a swarm at an out-apiary where it is desirable to hive it at once it is a good practice to place in the centre of the hive a frame of open brood taken from an established colony. This will prevent the bees absconding. The greatest care, however, must be exercised to ensure that disease is not thus transmitted. In hiving a swarm under such conditions place an empty super on top of the prepared hive, take the swarm in a bucket, and then shake the bees into the super. The frame of brood in the hive below generally attracts the bulk of the bees downwards; the balance can then be brushed from the sides of the super, the super taken off, and the swarm taken in a few minutes to its permanent location in the apiary.

To check any further swarming look over every frame carefully and cut out all but one queen-cell. It is necessary to handle the frames as gently as possible; do not shake the bees off the combs lest the one remaining queen-cell is destroyed. There is a possibility that the bees may swarm out with the young queen when she takes her maiden flight. If this does happen, put them back again without fail.

### General.

The hives should be rested on bricks or stands of some description, raising them about 6 in. off the ground. Place the bottom-board with a slight slope toward the front. Keep down the grass and weeds about the hive; a tangled entrance which hinders the exit and entry of the bees seriously affects the honey crop. If gable roofs are used, do not fail to use mats to prevent the bees building in the roof. Mats are not necessary with flat roofs.

—*E. A. Earp, Senior Apiarist.*

## HORTICULTURE.

### Vegetable Crops.

To produce good crops from seed, weeding requires close attention, especially while the crop plants are small. When the plants cover the ground there is less danger of their suffering a set-back owing to the competition of weeds for the available light, air, moisture, &c. Many crops are lost by being overgrown by weeds or only small crops are harvested at an uneconomical cost owing to the amount of labour spent on weeding. Serious weeds, such as couch-grass or twitch, are usually worked out of the ground before sowing, although not infrequently one finds a grower sanguine enough to sow or plant a herbaceous crop in ground infested in that way. Most of the weeds infesting a crop are from seeds in the ground which have been grown there, or have blown in, or have been brought in by birds. Stable manure, straw, or organic matter of many kinds that are ploughed under to enrich the soil may include weed-seeds unless the material is thoroughly fermented, when in most

instances they are sprouted and destroyed during the process. After deep cultivation land that was considered to be clean sometimes produces a heavy growth of weeds from seeds brought up near the surface from below, where they have lain dormant for years. Such is the hardihood of some weed-seeds.

The labour and cost of weeding is greatly reduced if during the preparation of the land for sowing it is allowed to lie and settle down for a fortnight or so after deep and thorough cultivation has been given. This rest allows the weed-seeds near the surface to sprout, when they may be readily destroyed on a fine day by means of a shallow stroke with hoes. If the crop is then sown without further deep cultivation, which may bring up more weed-seeds, the labour of dealing with this problem is greatly reduced.

Thinning the crop is also a formidable undertaking with many growers. Where plants are crowded in the rows it is impossible to obtain a good crop unless they are thinned out, which, under the best conditions, is a tedious undertaking. This labour is almost entirely avoided by carefully considering the germination percentage of the seeds and the desired distance between plants. They may then be sown sufficiently thin in the row to produce a crop which will require little or no thinning out afterwards.

Weeding and thinning seedling crops should now be given prompt attention as required. Weeds should be destroyed while small before they produce rough leaves, during fine weather ; and thinning should be done shortly after rain, when the young plants draw easily.

The shortage of organic manures makes it necessary, in most places, to carefully compost all available material. This means all animal and vegetable material which can be reduced to a thoroughly decayed state in about twelve months. This eliminates chiefly large bones and hardwood branches of any size, which are best burnt. The remainder should be built into a compact stack with perpendicular sides, in a humid shaded place, which are the conditions most conducive to decay. The method is to remove a foot of soil from an area 4 ft. to 6 ft. wide, and as long as necessary, piling the soil in equal quantities on either side. In this trench hedge-clippings, lawn-grass, house waste, fowl-manure, weeds, &c., should be built into a compact stack as it becomes available. About the time of the New Year the stack should be sealed by covering it with the foot of soil which was removed from the foundation.

Where soil is required for seed-boxes, potting, and top-dressing a stack of sufficient size should now be built of the top-spit of old pasture with the grass downwards. If at the end of twelve months it is cut down, broken up, and restacked it should be ready, after two or three years, to form the main ingredient in a first-class compost for the purposes mentioned above.

Where grassland is to be broken in for cropping a commencement may be made now by ploughing it shallow, just sufficiently deep to get beneath the roots of the present vegetation and turn it upside down. When the turf has been killed, so far as possible, it should be cultivated and harrowed to enable all twitch and other perennial weeds to be gathered and burnt before deep ploughing, in readiness for planting a crop during the autumn. The summer season usually affords good opportunities for cleaning foul land in this way. If the operation is not completed, then it may be necessary to sow the land down thickly with a cover crop at the time of the first autumn rains, with a view to smothering any weeds which remain.

During the month of November the sowing and planting of the half-hardy crops mentioned last month may now be done in the cooler districts, also garden swede-turnips should be sown.

### Small and Sundry Fruits.

For about three months during the Christmas period the main berry crops are ripe and mark the season of summer-time. Tree fruits are

practically off the market, and a good demand can always be relied on for these attractive berries. Most of them are very perishable unless, for long distance shipping, they are picked in firm condition. Even when the greatest care is taken such fruit as raspberries depreciate badly if subjected to much delay and handling. For this reason the distribution of these crops requires careful consideration, and definite plans made before harvesting commences. Picked when dry, of even maturity, and packed in clean bright packages, nothing in its class is more attractive.

During the month of November tomatoes in the unheated glasshouse commence to ripen. Watering, feeding, and ventilation then require close attention to maintain health and vigour while the crop is developing. Just what this means will depend on the soil and subsoil, also the climate, especially as regards temperature and sunshine. With four or five bunches of fruit set, some nitrogen may now be included in the manurial treatments without fear of the plants bolting to rank growth, but, even so, moderate quantities at intervals of a fortnight are better than larger doses at longer periods. Where there is any doubt as to the most suitable prescription, the following mixture may be tried, and afterwards modified as may be found advisable from the reactions experienced in the plants: Dissolve ½ oz. nitrate of soda, 1 oz. superphosphate, and ½ oz. sulphate of potash to each gallon of water, and apply at the rate of about one quart of the solution to each plant the day after watering. Before the fruit commences to colour it is usually advisable to lay a mulch of strawy stable manure or clean straw to conserve moisture and prevent splashing when watering. At the same time the base leaves, up to about the first bunch of fruit, are cut away, carried out, and destroyed. Among other things, this assists the colouring of the fruit and improves the circulation of the air in the house.

The tomato-weevil has been reported recently as doing serious damage to this crop under glass. The mature larvæ of this insect are legless, light green in colour, and about ½ in. in length. They are active during autumn, winter, and spring, when they enter the ground and form an earthen cell and the pupa is formed. The adult is a typical weevil, slow-moving and nocturnal in its habits; it feeds on vegetables of many kinds and some weeds, destroying chiefly the tender crown leaves; but the attack of larvæ on tomato crops in spring is the damage which has chiefly come under notice here. The control of *Listroderes costirostris* (*Desiantha nociva*) is by means of thorough cultivation of the soil, especially during late winter and spring, when the insects are passing through the pupal stage and are easily destroyed; the Paris green or arsenic poison bait broadcasted before planting as for cut worms; and spraying the plants attacked with a solution of arsenate of lead.

During the month of November the planting-out of half-hardy crops, mentioned under this heading in notes last month, should be completed. If this is done with care there will be little check to growth and the crops will be earlier and bigger. To water the plants the day before transplanting is usually advisable. Disturb the roots as little as possible, and do not expose them unnecessarily to the air; plant firmly, deep rather than otherwise, and avoid injuring the base of the stem when firming the plant are some of the necessary precautions.

**The Homestead Garden.**

Everybody appreciates a garden even if they do not like gardening. Good tree-shelter breaking the force of prevailing winds and rain is of decided utility for those who have to spend much of their time outside and greatly facilitates the maintenance of suitable temperatures in the home, while deciduous trees, well placed, afford shade for property and stock during warm summer days, which is quite as valuable. These features,

which necessarily include grassed open spaces of proportionate size, practically make up the garden, if areas for the production of fruit and vegetables are included. The selection of trees and shrubs for the above-mentioned purposes in any particular locality—their number, arrangement, and position—are matters requiring a great deal of consideration if it is to be done effectively without loss of time. In most instances it is the deciding factor, and where careful consideration is given generously the result is invariably good. In addition to one's own experience and preferences, it is advisable to carefully study the behaviour of mature trees and shrubs in the locality growing on the same class of soil, and under most circumstances it will be best to confine oneself to using only those which have proved successful. Decisions arrived at should be recorded in the form of a plan, to scale, on graph-paper with squares about ten to the inch. Each operation in the undertaking can then be carried out in season according to plan as opportunity offers.

Where gardens and gardening afford pleasure those living in homes in the country have special opportunities for the enjoyment of the art. Lawns may then be used for out-door sports, and an enclosed garden affords privacy and shelter for leisure moments, where, if garden seats are provided in shaded and sunny arbours, it will be popular with old and young at most seasons of the year. The summer period now commencing is most suitable for studying the problems connected with the construction of new gardens and alterations and additions to old ones, so that plans may be completed and ready for execution during the autumn months, which are perhaps quite the most suitable for that purpose.

Other work for the month of November includes the planting-out of half-hardy flowering annuals, dahlias, and chrysanthemums, also training and tying climbing plants, and plants in the herbaceous border. Common troubles which commence to make their appearance at this season are rose aphis and mildew. To keep the plants quite free from these troubles it is often necessary to spray them at regular intervals, and an early commencement is a great advantage. For the control of mildew some form of sulphur is the best remedy. The most generally useful probably is lime-sulphur, one part to fifteen of water applied as a fine spray in autumn, as soon as the leaves fall, and again just before growth commences in the spring. At the present time colloidal sulphur 2½ oz. to 4 gallons of water is best, or potassium sulphide, 1 oz. to the gallon, may be used. For aphis-control any contact insecticide will destroy them—nicotine sulphate is commonly used—but owing to their wonderful fecundity reinfection soon takes place in fine weather, and spraying must be repeated; where the attack is persistent a weekly application is sometimes necessary.

—*Wm. C. Hyde, Horticulturist, Wellington.*

A farmer of Tirau who owns a farm of 340 acres, carrying-capacity 1,300 breeding-ewes and from 180 to 200 head of cattle, has had good results with basic slag in top-dressing this past season. When growing root crops and sowing down permanent pasture his manurial treatment is equal parts of super and bones at the rate of 3 cwt. per acre. When old pasture is ploughed for root crops he applies 12 cwt. of carbonate of lime on the furrow. His usual top-dressing mixture is one sack of superphosphate (1¾ cwt.) and 1 sack of lime (1 cwt.) per acre. Last autumn he top-dressed part of his farm with basic slag at the rate of 3¼ cwt. per acre and the usual super-lime top-dressing on the remainder. The lambs from the ewes on the slagged country were all sold and forwarded to the freezing-works on the 20th November in one line; late lambs doing very well. Only one-third of the lambs from the super-lime top-dressed country were ready and sold at this same time.

# ANSWERS TO INQUIRIES.

**IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.**

## SPECIFICATIONS AND COST OF A SHEEP-DIP.

P. G. A., Tirau :—

Could you supply me with the specifications and cost of a sheep-dip to deal with three or four hundred ewes ?

The Live-stock Division :—

You have not stated which particular type of dip you favour, but as the " pot " bath is by far the most common in small sizes we will assume you favour this type. The sizes given are about the minimum economic size to build, as anything smaller will be too slow to work. A larger bath (which you would be well advised to build if you are anticipating an increase in the size of your flock) will be more expensive for first cost and in the fluid left unused at the bottom after dipping, but, on the other hand, will be correspondingly quicker and easier to work. The usual shape for this type of dip is conical like a gigantic flower-pot, but as the boxing required to mould the concrete is rather difficult to shape in the circular form, the average farmer will find it much easier and just as effective to make the bath square with the extreme corners removed This will do away entirely with any curves, and the boxing is then a straightforward job. You will find suitable dimensions to be : (*a*) In the case of a round dip, 6 ft. inside diameter at the top, and 3 ft. inside diameter at the bottom ; vertical depth, 5 ft (*b*) For a square dip, 6 ft. square at the top and 3 ft. square at the bottom ; vertical depth, 5 ft. The corners are cut off 1 ft. from each extreme corner—*i.e.*, a plank 17 in. wide is used to block off the corner. In each case the exit commences 1 ft. (vertical measurement) from the bottom of the dip and rises on an easy slope for 11 ft. (The horizontal measurement at ground level of the exit from the top inside rim of the bath is 9 ft.) The exit has a surface width—*i.e* , at any point along the top—of 20 in. ; the sides sloping down to a width of 12 in. (inside measurement) at the bottom. The same exit is used with either circular or square bath, and is provided with a vertical sliding wooden gate, preferably counterbalanced, where it leaves the dip. The capacity of these two dips when filled to within 6 in. of the top (this amount of freeboard is necessary) is approximately 620 gallons for the square dip and 550 gallons for the round one. In each case the bath is built of reinforced concrete. Two draining-pens should be provided, each measuring about 10 ft. by 30 ft., as this will mean that while one is being filled up the sheep in the other will have had time to drip sufficiently These pens should be floored with 3 in. reinforced concrete on a gentle slope, and all run-off should return to the bath via a sump and strainer to catch the dirt, and enter the bath well away from the sheep exit. With prices fluctuating as they are to-day, it is impossible to give even a reasonably exact estimate of the cost, but most firms interested in this work would be willing to give an estimate.

## VALUE OF CLUSTER PINE (PINUS PINASTER).

L. J., Taotaoroa, Cambridge :—

I have on my place, coming up very thickly, groves of the Pinaster pine, commonly known in the locality as wild pine. They are spreading very fast over country which can easily be brought into grass. I had decided to cut them, all except those on the steep faces and clumps and wind-breaks that would form good shelter. As they range in size from 2 in. to 12 in. in diameter and are in places as thick as 12 ft. apart, the task is likened unto bush-felling. Before I go much further I would like to have an expert opinion on the potential value of the Pinaster pine. Hitherto I have understood them useless and that grass would pay much better, but as the job is likely to be big in cutting them, I would like to make sure they will be no use in the future. The trees are extremely fast-growing. Five years ago they were just above the fern.

Horticulture Division :—

The planting of cluster pine (*Pinus pinaster*) is usually confined to seaside planting, where it makes useful shelter. As a timber tree it is of less value than *P. radiata* and others, but as it is established on your place and doing well the proposal to use it as shelter and, say, firewood, as you suggest, seems appropriate. The question of its timber value here, and whether it should be allowed to grow on land easily brought into grass, is best referred to the Forestry Department. The inquiry should be addressed to " The Director of Forestry, State Forest Service, 47 Fitzherbert Terrace, Wellington, N. 1."

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### SOWING OF CHOU MOELLIER FOR MAY FEEDING.

E. R., Wairoa (H.B.) :—

I am thinking of sowing a paddock of 6 acres, which carried a crop of turnips last winter and was fed off by sheep, in chou moellier this spring for feeding off by sheep in May, and should be very glad if you could give me the following information : (1) The best time to sow ; (2) quantity of seed to sow through a drill per acre ; (3) distance between rows ; (4) the most suitable fertilizer and quantity per acre. I presume that thinning is not necessary. Could you also tell me if there is more than one variety of chou moellier, and, if so, which is most suitable for sheep.

Fields Division :—

Taking your questions numerically, I answer them as follows : (1) If you wish to feed off in May the seed should be sown in early November ; if you were to sow any earlier it would probably run to seed before you were ready for it ; (2) and (3) 2 lb. of seed to the acre is the usual practice, sown in drills 14 in. apart (every other coulter) ; (4) sown as above, 3 cwt. of super or neutralized ammoniated super to the acre. Chou moellier is a very gross feeder and thrives best on land where well-rotted farmyard manure has been ploughed in and plenty of nitrogen is available. Hence the value of ammoniated super. Very good results have been obtained by first of all giving a top-dressing of 3 cwt. of ammoniated super, followed by drilling in the seed with a further 3 cwt. of super. On heavy clay land it is advisable to top-dress with half a ton carbonate of lime before sowing. It is important to obtain a quick establishment before the dry weather sets in, because, even should the plants be denuded of leaves by parasitic attack, the stems will throw out fresh growth in the autumn It is most important to plough early and cultivate the land deeply and thoroughly.

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# WEATHER RECORDS : SEPTEMBER, 1937.

Dominion Meteorological Office.

#### NOTES FOR SEPTEMBER.

SEPTEMBER was a rather mild month with little storm activity and generally an absence of extreme temperatures. Though the rainfall was considerably below normal over a large part of the country, skies were dull in these areas and there were few drying winds. Over most of the country, and especially the North Island and Marlborough, the rain was sufficient to keep the soil moist. In most districts there has been a good growth of crops, pastures, and other vegetation, but continued dull and wet weather has had a retarding effect in parts of the North Island and in Marlborough. Dry conditions prevailed, however, in most of Otago and South Canterbury, and good soaking rains will be required soon over much of the Dominion, especially if many dry north-westerly winds are experienced. Stock are

in good condition, and the weather has, in most places, been very favourable for lambing. There were some losses owing to excessive rain in Marlborough at the beginning of the month and in Canterbury owing to cold towards the latter end. A rather severe frost occurred in Hawke's Bay and the Manawatu on the 29th, and considerable damage was done to stone fruit and tender crops.

*Rainfall.*—Conditions as regards rainfall were rather varied over the North Island. Rain was frequent, but many of the falls were light. In the Poverty Bay and Bay of Plenty areas totals were considerably below average, but in most of the Hawke's Bay and Wellington Provinces above it. In the South Island most of Marlborough and North Canterbury had more than the average, but the remainder generally less. Very little rain was recorded in Central Otago.

*Temperatures.*—Temperatures differed very little from the average for September and the departures from normal showed little regularity. Though the frost of the 29th was severe in the southern portion of the North Island there was no occasion on which severe cold was general. The nights, for the most part, were mild. Where the temperature was below average it was generally due to the prevalence of cloudy skies and low day temperatures. The temperature of the soil is higher than usual for the time of year.

*Sunshine.*—In the Auckland and Taranaki Provinces the amount of bright sunshine was, at many places, slightly above average. Except at Invercargill, where there was only a slight deficit, the month elsewhere was one of the least sunny Septembers hitherto experienced. Tauranga had 190·3 and Hamilton East 185·1 hours.

*Storm Systems.*—During the first eight days conditions were unsettled. Several rather indefinite depressions affected the Dominion, culminating in a shallow cyclone which moved from the west across the North Island between the 5th and the 8th. Frequent and widespread rains occurred over the North Island and eastern districts of the South. The western and southern portions of the South Island, however, experienced very little. Temperatures were mild. A number of thunder and hail storms occurred in the North Island.

After a brief spell of anticyclonic conditions and fine weather a series of westerly depressions passed between the 10th and 15th. There were some opportune heavy rains in Westland, where a shortage of water for mining and other operations had been experienced. On the 12th westerly gales blew at numbers of places, and on the 14th some snow fell on the ranges of the South Island.

Fine weather prevailed from the 16th to the 19th. On the 20th another series of depressions commenced, including a shallow cyclone which crossed the Cook Strait area on the 22nd and was followed by strong southerlies on the 24th. Heavy rain occurred in the central provinces. There was cold weather from the 23rd to the 25th, especially over the South Island, where snow fell in places.

On the 27th a rather unusual type of westerly depression crossed the southern portion of the South Island and as it passed a southerly change moved rapidly over the Dominion, gales blowing in the South Island. Snow fell on most of the ranges and there was thunder and hail in places. A similar depression was passing at the end of the month.

RAINFALLS FOR SEPTEMBER, 1937.

| Station. | Total Fall. | Wet Days. | Maximum Fall. | Average September Fall. | Total Fall to date. | Average Fall to date. |
|---|---|---|---|---|---|---|
| *North Island.* | | | | | | |
| | Inches. | | Inches. | Inches. | Inches. | Inches. |
| Kaitaia .. .. | 5·59 | 20 | 0·91 | 4·90 | 49·93 | 43·66 |
| Russell .. .. | 2·70 | 16 | 0·60 | 4·98 | 84·95 | 47·84 |
| Whangarei .. .. | .. | .. | .. | 4·84 | .. | 49·95 |
| Auckland .. .. | 4·29 | 22 | 0·83 | 4·05 | 36·04 | 38·52 |
| Hamilton .. .. | 3·49 | 17 | 1·07 | 4·32 | 31·85 | 37·43 |
| Rotorua .. .. | 3·48 | 19 | 1·08 | 4·97 | 36·50 | 31·83 |
| Kawhia .. .. | .. | .. | .. | 4·57 | .. | 40·75 |
| New Plymouth .. | 4·79 | 20 | 0·73 | 4·92 | 44·92 | 45·33 |
| Riversdale, Inglewood .. | 7·24 | 21 | 0·94 | 9·56 | 70·31 | 77·16 |
| Whangamomona .. | .. | .. | .. | 7·11 | .. | 56·10 |
| Hawera .. .. | 3·54 | 20 | 0·66 | 3·42 | 31·03 | 33·53 |
| Tairua .. .. | 3·33 | 13 | 1·02 | 4·92 | 43·87 | 50·63 |
| Tauranga .. .. | 3·85 | 18 | 0·78 | 4·29 | 42·29 | 40·41 |
| Maraehako Station, Opotiki | 4·95 | 16 | 1·33 | 4·21 | 48·46 | 41·94 |
| Gisborne .. .. | .. | .. | .. | 2·99 | .. | 37·28 |
| Taupo .. .. | 3·64 | 16 | 1·16 | 3·82 | 25·23 | 33·12 |
| Napier .. .. | 2·65 | 16 | 0·86 | 1·93 | 19·47 | 24·23 |
| Hastings .. .. | 2·29 | 12 | 0·96 | 2·63 | 15·98 | 26·05 |
| Taihape .. .. | 3·29 | 21 | 0·70 | 3·04 | 23·88 | 26·56 |
| Masterton .. .. | 3·39 | 19 | 0·73 | 3·00 | 26·20 | 29·54 |
| Patea .. .. | 4·43 | 22 | 0·73 | 3·59 | 32·44 | 33·03 |
| Wanganui .. .. | 3·01 | 15 | 0·56 | 2·87 | 24·14 | 26·72 |
| Foxton .. .. | 2·58 | 17 | 0·61 | 2·40 | 17·90 | 23·73 |
| Wellington .. .. | 3·51 | 20 | 1·19 | 3·20 | 27·13 | 32·87 |
| *South Island.* | | | | | | |
| Westport .. .. | .. | .. | .. | 8·30 | .. | 70·80 |
| Greymouth .. .. | 6·32 | 17 | 1·15 | 8·09 | 73·04 | 73·06 |
| Hokitika .. .. | 6·16 | 14 | 1·66 | 9·02 | 78·35 | 82·31 |
| Ross .. .. | 10·32 | 11 | 2·23 | 12·43 | 95·97 | 94·81 |
| Arthur's Pass .. | .. | .. | .. | 15·29 | .. | 111·36 |
| Okuru, Westland .. | 12·96 | 8 | 2·65 | 11·89 | 112·08 | 105·69 |
| Collingwood .. .. | 6·80 | 18 | 1·46 | 9·31 | 62·98 | 71·76 |
| Nelson .. .. | 1·12 | 15 | 0·29 | 3·58 | 25·02 | 28·44 |
| Spring Creek, Blenheim | 2·54 | 15 | 0·95 | 2·59 | 20·07 | 23·23 |
| Seddon .. .. | 3·24 | 10 | 0·90 | 2·14 | 19·84 | 18·76 |
| Hanmer Springs .. | 5·40 | 18 | 1·21 | 4·43 | 26·72 | 33·91 |
| Highfield, Waiau .. | 3·18 | 18 | 0·85 | 2·99 | 17·75 | 25·52 |
| Gore Bay .. .. | .. | .. | .. | 2·94 | .. | 24·25 |
| Christchurch .. .. | 1·83 | 13 | 0·63 | 1·93 | 18·30 | 18·92 |
| Timaru .. .. | 1·45 | 11 | 0·37 | 1·90 | 16·06 | 16·33 |
| Lambrook Station, Fairlie | 1·50 | 10 | 0·41 | 2·18 | 14·31 | 18·31 |
| Benmore Station, Clearburn | 0·90 | 10 | 0·29 | 1·93 | 19·47 | 17·95 |
| Oamaru .. .. | 1·63 | 14 | 0·47 | 1·64 | 12·88 | 16·08 |
| Queenstown .. .. | .. | .. | .. | 2·54 | .. | 21·97 |
| Clyde .. .. | 0·46 | 6 | 0·22 | 1·05 | 11·59 | 10·50 |
| Dunedin .. .. | 2·19 | 15 | 0·58 | 2·75 | 32·25 | 26·88 |
| Wendon .. .. | 1·42 | 12 | 0·40 | 2·42 | 32·53 | 21·69 |
| Balclutha .. .. | 1·28 | 12 | 0·30 | 1·89 | 25·79 | 18·16 |
| Invercargill .. .. | 2·49 | 18 | 0·50 | 3·24 | 32·79 | 33·02 |
| Puysegur Point .. | 5·06 | 19 | 1·05 | 6·36 | 66·45 | 61·71 |
| Half-moon Bay .. | .. | .. | .. | 5·02 | .. | 42·94 |

# Ruakura Farm Training College,

## HAMILTON.

THE Ruakura Farm of Instruction is situated in Waikato County, and adjoins the Borough of Hamilton. The farm was established as an experimental station in 1901. The training of farm students was commenced in 1912, from which time twelve students were continuously in residence. In 1920 buildings were erected to accommodate sixty returned soldiers. On the completion of the repatriation work the teaching of farm students was reorganized, and a system of resident instruction was established in August, 1923, the educational institution being termed the Ruakura Farm Training College.

### COURSE OF INSTRUCTION.

The course of instruction is designed entirely for the requirements of the farmer—not of the agricultural teacher or research worker. The full curriculum occupies twelve months. The year is divided into two terms of twenty-four weeks. New students may enter the college either in January or June. The first term begins on or about 7th January, and the second term on or about 20th June.

A prospectus giving all details may be obtained from the Director of the Fields Division, Department of Agriculture, Wellington, or the Manager, Ruakura Farm of Instruction, Hamilton.

### FEES.

The fee for each term for tuition and board (including soft washing) is £18. All fees are payable in advance. Students leaving before the end of their course are required to give three months' notice.

Stationery is supplied at wholesale prices.

### ADMISSION OF STUDENTS.

The course of instruction is open to lads of not less than sixteen years of age and of reasonable educational attainments.

Applications for the second term (1937), commencing 5th July, should be submitted as early as possible.

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## PACKING APPLES AND PEARS IN STANDARD CASES.

WM. C. HYDE, A. T. DOUGLAS, and R. E. BINFIELD.

Harvesting, packing, and storage are important links in the chain of operations in fruit-production, and very often the weakest. Common mistakes and some of the best methods in use at the present time are dealt with in the following pages.

### HARVESTING THE APPLE CROP.

*When to pick the Fruit.*—Apples usually are best picked as soon as they reach maturity. This may be indicated by the colour of the skin or seeds, also the flavour and the readiness with which the fruit parts from the tree. It is not always so much the red colour of the skin as the shade of ground-colour; this perceptibly lightens as the fruit approaches maturity. Wide experience and careful examination are necessary to decide this important point, the neglect of which is a common and serious mistake. If left on the trees too long the skin of the fruit is liable to be disfigured by spotting, the texture of the flesh deteriorates, and juice and keeping-qualities may be lost. The harvesting of apples commences early in January, and recognized commercial varieties are ready for picking according to the purpose for which they are required in approximately the following order: Gravenstein, Scarlet Pearmain, Worcester Pearmain, Golden Pippin, Willie Sharp, Ribston Pippin, Alfriston, Cox's Orange Pippin, King David, Dunn's, Jonathan, Delicious, Lord Wolseley, Cleopatra, London Pippin, Ballarat, Rome Beauty, Grannie Smith, Statesman, Sturmer, and Dougherty, the latter reaching maturity about the end of the month of April.

*Picking-equipment.*—The fruit is best picked and placed in a substantial bag or bucket suspended from the shoulders in a way that it will not swing unduly, hinder the picker, or bruise the fruit. Strong orchard-boxes are required, and into these the fruit is emptied from the picking-bag. Handy tressels and ladders, no higher than necessary and as light as possible, are most suitable for picking the upper branches. The three-legged ladder commonly used is very suitable. To collect the orchard-boxes when filled, a low-wagon without sides is used to cart the fruit to the packing-shed, or on rough ground a large sledge may sometimes be used.

FIG. 1. HARVESTING THE APPLE CROP.

Note the tripod ladder and picking-buckets. Cases should be filled only within an inch of the top to avoid bruising when stacking.

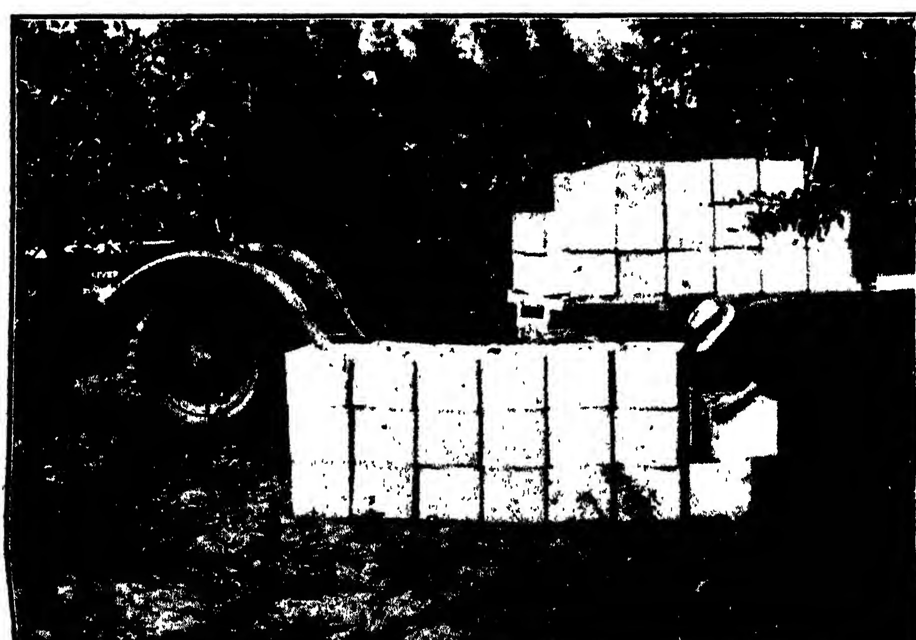

FIG. 2. A LOW-SET, WELL-SPRUNG WAGON IS MOST SUITABLE FOR CARTING APPLES FROM THE ORCHARD.

*How to pick.*—Inexperienced pickers should be carefully supervised until they become accustomed to the work. Apples on a tree do not all mature at the same time, and serious loss has been incurred by immature fruit being picked. The apples at the top and on the sunny side of the tree mature first; the remainder as the colour and size develops are picked. For some varieties several pickings are necessary.

The fruit should be picked with an upward movement, when, if mature, it parts readily without injury to the spur, without loss of the stem or rupture of the base of the stem, which is the cause of so much stem-rot in storage. At a picking all mature fruit should be gathered. If any is overlooked or immature fruit picked, there is a loss. Pickers should trim their finger-nails close, and handle the fruit with the greatest care to prevent injury or bruising. Orchard boxes are filled so that they may be stacked without bruising the fruit, and stood on the shady side of the tree in readiness for carting. Unsound fruit should not be placed in the boxes. There is usually very little, and it is generally best placed at the foot of the tree, where it may be collected later.

## Packing Apples in the Standard Case.

*The Packing-shed.*—As a considerable quantity of fruit will be in this building during the summer and autumn, also possibly during the winter awaiting a market, it should be placed in a cool as well as convenient position.

A concrete floor is very suitable, as it is easily kept clean, and wooden floors often give trouble when carrying heavy loads. A good light is required on the packing and grading tables, and ample ventilation in the gables or along the ridge of the roof, in addition to wide doors for the traffic of goods. The house should be built so that as little dust as possible can lie about, as cleanliness in the packing-shed enhances the keeping-qualities of fruit. The shed should be of sufficient size to accommodate an ample supply of fruit in orchard-boxes, packing-equipment, and stacks of packed fruit. The timber and box-making department is generally in an annex, or in a loft above the ground floor.

*Packing-equipment.*—Equipment for the packing-shed consists of a boxmaking bench, fruit-grader, nailing-press, and wiring-machine; also supplies of timber, nails, wrapping-paper, liners, pads, labels, rubber-stamps, paste, brushes, and wire. In a large establishment a section of the shed is partitioned off for an office and store-room for supplies. The arrangement of the equipment is carefully studied so as to secure the greatest economy of labour. Roller conveyers carry the packed fruit to the nailing-down press. In such an establishment a mechanical grader is used to size the fruit and convey it to bins, in each of which fruit of one size is piled ready for the packer. Mechanical graders of different styles and capacity may be obtained for this purpose. For driving the mechanical grader an electric motor is preferred. An oil-driven motor is a good substitute, but it should be placed outside the packing-shed under cover. Artificial lighting is a great convenience, as it enables packing to be done at night during rush periods. The grading-table, packing-bins, and nailing-press should receive special attention in this respect.

In many small establishments the fruit is graded and sized by hand, either direct from the orchard-boxes or from a hessian-covered table on which the fruit has been tipped. A row of bins for fruit of different sizes will then be required. Useful equipment of this kind can very well be made by the orchardist.

The standard apple-box, having an inside measurement of 10½ in. by 11½ in. by 18 in., is made up from cut timber supplied in bundle form with definite counts of end, side, top, and bottom pieces, and cleats, the dimensions of which are as follows:—

Ends: Two pieces, each planed on one side, ¾ in. by 11½ in. by 10½ in.
Sides: Two pieces, $\frac{5}{16}$ in. by 19½ in. by 10½ in.
Tops and bottoms: Four pieces, $\frac{3}{16}$ in. by 19½ in. by 5½ in.
Cleats: Four pieces, $\frac{5}{16}$ in. by 11½ in. by ¾ in.

Cases made of two-piece sides and two-piece ends are sometimes used, provided the side boards are of equal width and are cut or planed to an equal thickness. The grain of the end boards is parallel with its greatest measurement and the two pieces are securely joined by means of corrugated fasteners, one close to each edge on the one side and one midway between on the reverse side.

The local timber recommended for the construction of export cases is white-pine of good quality, but *Pinus insignis*, rimu, or beech timber is acceptable if properly cut and used with flexible tops and bottoms not exceeding $\frac{3}{16}$ in. in thickness.

The nails used are at least 1½ in. long, 14 gauge.

All fruit exported, and much of that which is placed on the local market, is wrapped individually in paper glazed on one side.

The following sizes are most suitable:—

For apples 96 and larger to case use 11 in. by 11 in. paper or double wrap with 10 in. by 10 in.
For apples 100–138 to case use 10 in. by 10 in.
For apples 150–180 to case use 10 in. by 10 in. or 9 in. by 9 in.
For apples 198–234 to case use 9 in. by 9 in.
For apples 252–270 to case use 8 in. by 8 in.

*Organization of the Staff.*—A large packing-shed during the harvest is a very busy place, and good administration is necessary to get the work done quickly and well. If the planting has been done wisely, the harvest will be conveniently spread to enable large quantities of fruit to be handled with a moderate sized staff.

It is important to see that pickers, graders, packers, boxmakers, and the man nailing down thoroughly understand their duties as they are very exacting. The supply of fruit from the orchard and casemaking should be regulated to the requirement of graders and packers, to avoid congestion and double handling or loss of time. Help will also be required to supply fruit to the graders, empty boxes to packers, and remove low-grade fruit. Good management will secure a happy, capable crew that will do good work without waste. The man nailing down and wiring cases should be very capable and familiar with all regulation requirements. He should return all packed boxes not up to standard, as he is the last man to see the pack he should be finally responsible.

FIG. 3. TO MAKE GOOD BOXES QUICKLY A SUBSTANTIAL BENCH, PROPERLY EQUIPPED, IS REQUIRED.

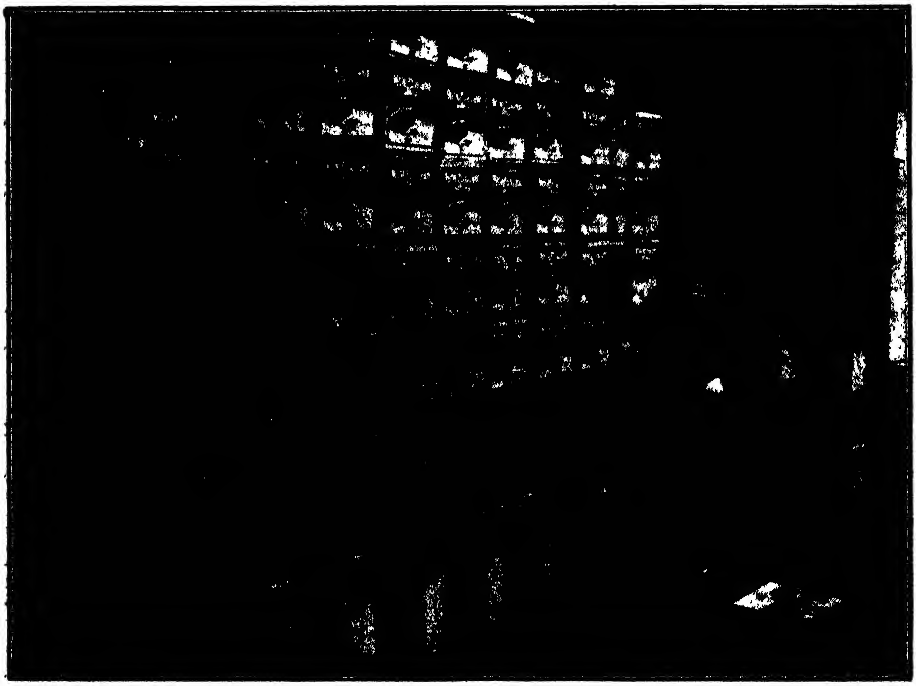

FIG. 4. LABELS MUST BE CLEAN AND LIGHT. LINE UP THE BOXES, APPLY A GOOD PASTE, THEN THE LABELS, AND FINISH WITH A CLEAN BRUSH.

*Making and labelling Boxes.*—To give a box good appearance and sufficient strength, boxmaking and labelling are carefully specified, and this should be carried out with equal care. The end pieces of a box are placed in a steel or wooden frame on the bench, planed side outermost, one side is nailed on; it is then turned and the other side board is fastened in position, after which the bottom pieces and cleats are laid in position and securely nailed. The corners should be square and flush, and the nails, spaced not more than 3 in. apart, should be driven flush and not sunk; the outer nails being not more than 1 in. from the edge of the board. Nails with point projecting when driven must be withdrawn. All cases should be clean, dry, and sound, and well up to measurement.

As the contents and consignment-marks are usually placed on the label, the necessity of good labelling is obvious, for when they become torn or lost altogether, as sometimes happens, serious difficulties arise. There are many right ways and wrong ways of labelling; one of the former is as follows:—

Place the box-ends planed side uppermost before making up in a row on a bench, or slide long enough to hold twenty-five or fifty of them. Apply the paste to the boards with a wide brush, and then take the labels and place them carefully in position. With a clean brush each label is then pressed firmly to the wood with a motion from the centre outwards to avoid air bubbles, and the labelled ends are stacked to dry before making them up. Any convenient method is satisfactory so long as a clean, fresh, reliable paste is used and the label is properly placed and firmly affixed over the whole of its area. Labels should as far as possible be overprinted with essential particulars, leaving only the count—that is, the number of apples per case—to be applied with a rubber stamp.

For the export trade a label of approved design is placed on each end of every case, words and figures indicating the following only are permissible on the label: (1) "New Zealand Apples"—"New Zealand" to be composed of 1¼ in. letters and the word "Apples" ¾ in. in height; (2) grower's registered number to be of 1¼ in. type; (3) consignee's registered number or shipping-mark to be of figures not less than 2½ in. and not more than 3 in. in height; (4) name of variety of apple, grade, and number of apples in the case—all of which must be of ½ in. type. The grade is printed on each label. The name of the variety must be placed immediately above, and the number—indicating the apples in the case—on the right of, and in line with, the grade name. These particulars are usually overprinted on the label, with the exception of the count, which is applied with rubber stamps at the nailing-press.

*Grading and Sizing the Fruit.*—The fruit in orchard boxes are received at the packing-shed and stacked to a convenient height from five to six cases high, according to the space available adjacent to the grading-table. Fruit may be stacked on both sides of the grader if space will permit, as this enables the person in charge of the grading to deal with the fruit according to the length of time

FIG. 5. INTERIOR OF PACKING-SHED DURING THE HARVEST

Over the grading-machine are the empty boxes As they are packed the packers' tally-card is inserted and the box is placed on the conveyer and passed to the lidding-press.

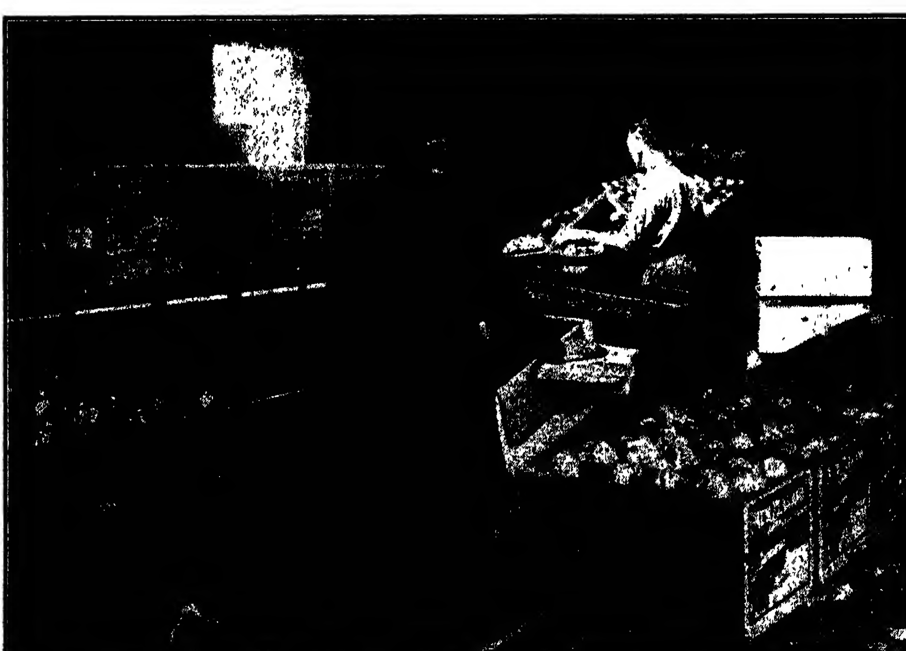

FIG. 6. EQUIPMENT SUITED TO ANY REQUIREMENT IS NOW AVAILABLE.

it has been picked. To prevent heating and to allow the air to circulate through the stack, the cases should stand a few inches clear of the walls and an inch or so between the perpendicular tiers. It should remain there at least twenty-four hours to permit a certain amount of evaporation, which will minimize wet brushes and blemish marks in packing and handling. This is specially important if recent rains have been experienced.

The fruit is graded and sized by carefully tipping it on a grading-table, where defective fruit is removed, placed in boxes, and stacked by itself. The remainder is passed over a sizing-machine and comes to rest in bins, in each of which the fruit is all of one size and grade ready for the packer. Most machines of this kind of any capacity do good work, but it is essential that they be kept thoroughly clean and adjustments carefully watched. Apart from this mechanical supervision, less skill and experience are required by the operators as compared with grading and sizing by hand. The latter method, however, is suitable for small packing-sheds, and experienced operators will instantly decide the grade and size of fruit when they handle it. Such graders sort into a row of bins from one side, while the packers pack out of the bins on the other side. The bins have padded bottoms, which are slightly inclined towards the packers, and have an opening, an inch or so wide, between the lower edge and side of the bin to allow dust and litter of any kind to be readily removed by brushing. The graders may work from orchard-boxes or from a narrow table about 2 ft. wide covered with hessian on which the fruit is tipped.

A common fault which tends to injure fruit while grading is the overloading of the grading-table, conveyer-rollers, and belts, resulting in crowding apples in restricted spaces, causing stem punctures, scratches, and abrasions. Sufficient fruit only to keep the packers employed should be allowed in the bins. Overloading the packing-bins is a common source of injury to fruit.

Standard grades for apples and sizes packed are subject to slight alteration each season—those set for the 1937 export season are as follows :—

*"Extra Fancy," "Fancy," and "Good" Grades.*—Apples of these grades shall be mature, sound, smooth, clean, well formed, carefully hand-picked from the tree, properly wrapped, true to name, and free from disease, visible bitter-pit, skin-puncture, or skin broken at stem, and other defects which cause fruit to decay or which are likely to make the fruit unattractive to the consumer. Individual apples of either grade shall carry not less than the percentage of colour, and not more than the percentage of blemish and unnatural russet indicated in the appended general list with respect to each variety in the respective grades.

Insignificant healed-over insect stings or bites in export fruit shall be limited as follows: "Extra Fancy," not exceeding 5 per cent., with no more than one sting or bite on individual fruits; "Fancy" and "Good" grade, not exceeding 10 per cent., with no more than two stings or bites on individual fruits.

XF = Extra Fancy; F = Fancy; G = Good; HCC = High characteristic colour; GCC = Good characteristic colour.

| Varieties. | Sizes. United Kingdom. Max. | Sizes. United Kingdom. Min. | Sizes. Continent of Europe. Max. | Sizes. Continent of Europe. Min. | Sizes. Other Markets. Max. | Sizes. Other Markets. Min. | Colour. XF. % | Colour. F, % | Colour. G, % | Blemish. XF, % | Blemish. F, % | Blemish. G, % | Russet. XF, % | Russet. F, % | Russet. G, % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Solid Red.* | | | | | | | | | | | | | | | |
| 1. Rokewood .. .. | 125 | 252 | 125 | 198 | 125 | 252 | 60 | 25 | 10 | 3 | 3 | 5 | 5 | 10 | 20 |
| 2 Tasma .. .. | 125 | 216 | 125 | 198 | 125 | 216 | 70 | 30 | 10 | 3 | 3 | 5 | 5 | 10 | 20 |
| *Partial Red.* | | | | | | | | | | | | | | | |
| 3. Brighton .. .. | 125 | 234 | 125 | 198 | 125 | 234 | 45 | 15 | 5 | 3 | 3 | 5 | 5 | 10 | 20 |
| 4. Delicious .. .. | 125 | 216 | 125 | 198 | 125 | 216 | 45 | 15 | 5 | 3 | 3 | 5 | 5 | 15 | 30 |
| 5. Dougherty .. | 125 | 252 | 125 | 198 | 125 | 252 | 45 | 15 | 5 | 3 | 3 | 5 | 5 | 10 | 20 |
| 6. Frimley Beauty .. | 125 | 234 | 125 | 198 | 125 | 234 | 45 | 15 | 5 | 3 | 3 | 5 | 5 | 10 | 20 |
| 7. Glengyle Red .. | 125 | 234 | 125 | 198 | 125 | 234 | 45 | 15 | 5 | 3 | 3 | 5 | 5 | 10 | 20 |
| 8 Jonathan .. | 125 | 234 | 125 | 198 | 125 | 234 | 45 | 15 | 5 | 3 | 3 | 5 | 5 | 15 | 25 |
| 9 Scarlet Nonpareil .. | 125 | 234 | 125 | 198 | 125 | 234 | 45 | 15 | 5 | 3 | 3 | 5 | 5 | 10 | 20 |
| 10 Stark .. .. | 125 | 234 | 125 | 198 | 125 | 234 | 45 | 15 | 5 | 3 | 3 | 5 | 5 | 10 | 20 |
| 11 Worcester Pearmain | 138 | 234 | .. | .. | 138 | 234 | 45 | 15 | 5 | 3 | 3 | 5 | 5 | 10 | 20 |
| 12 Yates .. .. | 138 | 252 | 138 | 198 | 138 | 252 | 45 | 15 | 5 | 3 | 3 | 5 | 5 | 10 | 20 |
| *Striped.* | | | | | | | | | | | | | | | |
| 13. Cox's Orange Pippin | 150 | 270 | .. | .. | 150 | 270 | 20 | 5 | * | 3 | 3 | 5 | 5 | 30 | 50 |
| 14 Gravenstein .. | 138 | 234 | .. | .. | 138 | 234 | † | † | † | 3 | 3 | † | 5 | 10 | † |
| 15. Kidd's Orange Red | 138 | 234 | 138 | 198 | 138 | 234 | 25 | 10 | * | 3 | 3 | 5 | 5 | 10 | 20 |
| 16 Rome Beauty .. | 125 | 234 | 125 | 198 | 125 | 234 | 25 | 10 | * | 3 | 3 | 5 | 5 | 10 | 20 |
| 17 Statesman .. | 125 | 234 | 125 | 198 | 125 | 234 | 20 | 5 | * | 3 | 3 | 5 | 5 | 10 | 20 |
| *Yellow or Green.* | | | | | | | | | | | | | | | |
| 18 Alfriston .. .. | 88 | 198 | 88 | 198 | 88 | 198 | HCC | GCC | .. | 3 | 3 | .. | 2 | 12½ | No good grade allowed |
| 19. Ballarat .. .. | 88 | 198 | 88 | 198 | 88 | 198 | HCC | GCC | .. | 3 | 3 | .. | 2 | 12½ | |
| 20. Cleopatra .. | 125 | 234 | 125 | 198 | 125 | 234 | HCC | GCC | .. | 3 | 3 | .. | 2 | 12½ | |
| 21. Dunn's .. .. | 96 | 216 | 96 | 198 | 96 | 216 | HCC | GCC | .. | 3 | 3 | .. | 2 | 12½ | |
| 22. Golden Delicious .. | 125 | 216 | 125 | 198 | 125 | 216 | HCC | GCC | .. | 3 | 3 | .. | 2 | 12½ | |
| 23. Grannie Smith .. | 113 | 234 | 113 | 198 | 113 | 234 | HCC | GCC | .. | 3 | 3 | .. | 2 | 12½ | |
| 24. London Pippin .. | 125 | 216 | 125 | 198 | 125 | 216 | HCC | GCC | .. | 3 | 3 | .. | 2 | 12½ | |
| 25. Lord Wolseley .. | 113 | 216 | 113 | 198 | 113 | 216 | HCC | GCC | .. | 3 | 3 | .. | 2 | 12½ | |
| 26. Newtown Pippin .. | 125 | 234 | 125 | 198 | 125 | 234 | HCC | GCC | .. | 3 | 3 | .. | 2 | 12½ | |
| 27. Parlin's Beauty .. | 96 | 216 | 96 | 198 | 96 | 216 | HCC | GCC | .. | 3 | 3 | .. | 2 | 12½ | |
| 28. Pioneer .. .. | 138 | 234 | 138 | 198 | 138 | 234 | HCC | GCC | .. | 3 | 3 | .. | 2 | 12½ | |
| 29. Sturmer Pippin .. | 125 | 234 | 125 | 198 | 125 | 234 | HCC | GCC | .. | 3 | 3 | .. | 15 | 75 | |
| 30. Willie Sharp .. | 125 | 234 | .. | .. | 125 | 234 | HCC | GCC | .. | 3 | 3 | .. | 2 | 12½ | |

* Colour showing. † Colour requirements of Gravenstein: Extra fancy—pronounced stripe; Fancy—clean bright fruit. Good grade of this variety will not be accepted for export.

*(To be continued.)*

On a light-land farm in Canterbury two adjacent paddocks, which had originally been sown down with the same mixture, provide a striking example of what subterranean clover can do for a pasture. One of these paddocks was surface-sown with subterranean clover two years ago and now carries a good cover of rye-grass, while the pasture in the other paddock has entirely run out, being practically all hair-grass.

# LIVER-FLUKE IN NEW ZEALAND SHEEP.

W. V. MACFARLANE, Zoologist, Veterinary Laboratory, Wallaceville.

SPORADIC outbreaks of black disease in sheep have occurred since the first investigation of the trouble in the years 1924 to 1928 in spite of the efforts that have been made to control the factors causing mortality. It was shown at that time that the larval liver-fluke (*Fasciola hepatica*) entered the liver and burrowed through the tissues to stimulate the growth of the bacillus *Clostridium oedematiens*. The toxin derived from the bacillus caused the death of the infected animal. During the first half of 1937 the death of at least five hundred sheep, chiefly breeding-ewes, from black disease has come to the notice of the Department in Hawke's Bay. In addition to this loss there is still a large number of rejections of livers at the meat-works because of the presence of fluke, and the liver-fluke is, after hydatids, the most serious cause of condemnation of livers at the works in the fluke area. Direct loss of sheep, however, or wasting of their condition from the presence of large numbers of adult fluke in the bile-ducts is now negligible as a result of the regular drenching with carbon tetrachloride which has been undertaken in Hawke's Bay.

The mammalian hosts of the liver-fluke are sheep, cattle, goats, rabbits, and, occasionally, man. It was formerly considered that the intermediate host of the parasite was the small black mollusc *Potamopyrgus*. Large populations of *Potamopyrgus* spp. are common in streams and lakes throughout the country. This genus is sharp-spired, there are six tight whorls to the shell, and the opening of the shell is able to be closed by an operculum (Fig. 1 (v) ). This is not the host of the liver-fluke, however, though it harbours the immature forms of at least fourteen other flukes whose adults live in fish, birds, or mammals. An examination of 5,200 specimens of this genus did not reveal one infection with fluke; and that observation was supported by the fact that the miracidium hatched from fluke eggs would not penetrate the tissues of *Potamopyrgus antipodum* or *P. corolla*.

In Hawke's Bay and Poverty Bay the only intermediate host of the fluke that was discovered in the recent reinvestigation was *Myxas ampulla* (Fig. 1 (iii), (iv) ). This snail grows to the length of one centimeter. It is a broad-shelled animal of a grey or green-brown colour. There are four whorls to the shell; the first three apical whorls are small and the fourth is large and ovoid to shelter the greater part of the animal. The fleshy foot protudes slightly from the opening of the large whorl, and there is no operculum to the shell. Examination was made of 2,300 specimens of this snail, and fluke infection was found to vary in different localities from complete absence to 43 per cent. In a normal fluke-infested pasture there are usually about 5 per cent. of the *Myxas* carrying parasites. The identity of the parasite was established by feeding the cysts to laboratory-bred rabbits, from which mature fluke were recovered after fifty days.

Occasionally species of *Isidora* (Fig. 1 (i), (ii) ) may be found in lagoons, but they may be readily distinguished from the fluke snail by the fact that the whorls twist to the left. In *Myxas* the whorls twist to the right.

## Habitats of Myxas ampulla.

The habitats of *Myxas* are well defined and limited. The snail is an air-breathing animal adapted for life on muddy areas. Accordingly it is not found in deep or fast-running waters with clearly cut banks. The characteristic locality in which *Myxas* lives is a seepage from the hillside where the flow of water is imperceptibly slow but is constant throughout the year. Stagnant water is quite unsuitable: it is well-aerated water that is required. A short green

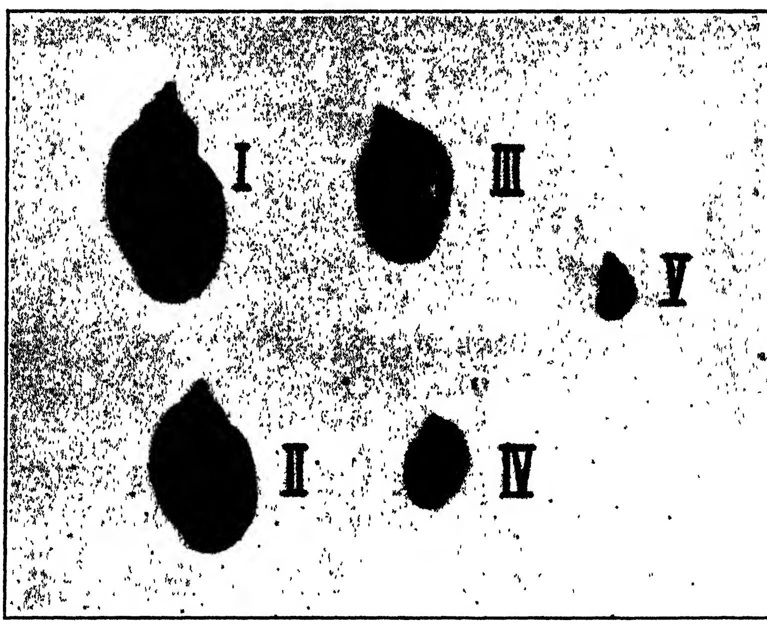


FIG. 1.

I and II: *Isidora* spp. These molluscs are rare, and are not infected with fluke. III: Full-grown *Myxas ampulla*, 1 cm long. This snail is the only known host of liver-fluke in New Zealand. IV. Half-grown *Myxas ampulla* V: *Polamopyrgus antipodum*. The common and widespread stream snail that has been shown *not* to be on intermediate host of the fluke.

rush (*Juncus lampocarpus* (Fig. 2) ) grows in such seepages, and when it is growing sparsely with extensive patches of bare mud in the association it provides the best habitat (Fig. 3). Only fine silty loams form a suitable substratum for *Myxas*, which may be found either moving over the soft mud or mating in the water-filled hoof-marks of the swamp.

Where the *J. lampocarpus* grows very densely or where large growths of moss and algæ have taken place, *Myxas* will seldom be found.

Besides on the swamp ground formed from springs, fluke-snail habitats develop on flats in the course of streams where depositions of silt have been overgrown by short green rushes. Some good cultures of *Myxas* are also found on open stretches of soft mud where *J. lampocarpus* does not grow. An example of this occurs on the bed of the former Inner Harbour at Napier.

FIG. 2.

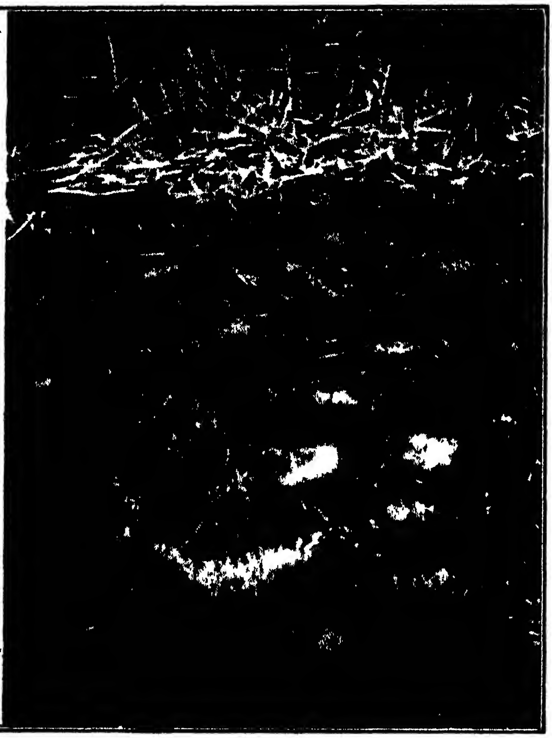

FIG. 3.

*Fig. 2.*—A single plant of *Juncus lampocarpus*, the short rush that grows on the fine mud of the swamps inhabited by *Myxas*.

*Fig. 3.*—A typical fluke-infested area formed from a hillside seepage. Water is seen lying in depressions trampled by stock with a growth of *Juncus* around each depression. The silt of this swamp is formed from sandstone, limestone, and Taupo pumice, and is grey-brown in colour.

Patches of watercress, drains in which the water flows fairly rapidly, and stagnant brown waters are unimportant in the spreading of the fluke. Sluggish drains that have become overgrown with cress or rushes accommodate small numbers of *Myxas*.

Stock are infected, therefore, by eating the rushes or drinking from depressions in the swamp where fluke cercariæ are encysted.

## Distribution.

The liver-fluke has been reported from areas near Nelson, Opotiki, and Ngaruawahia, and its incidence has been studied in Hawke's Bay and Poverty Bay. Fluke swamps are formed on grey, brown, and dull-yellow

soils. The derivation of these soils is limestone (grey), limestone, sandstone, and pumice (grey-brown), sandstone (dull yellow), and mudstone (grey). On the east coast of the North Island limestone and sandstone fluke habitats are found from Dannevirke to Tutira. From Tutira northwards the coastal soils are basically either sandstone or mudstone, with a short outcrop of limestone from Nuhaka to Tiniroto.

Very few snails and no fluke have been found on the red soils formed from the volcanic ash showers (from Tongariro) which do not extend farther east than Kereru, Puketitiri, and Te Pohue. The Taupo rhyolitic pumice does not disturb the incidence of *Myxas*. Peat and peaty loam is inimical to *Myxas*. South of Dannevirke, and in the greywacke foothills of the ranges (Ruahines, Raukumaras, Kawekas), the snail has not been seen. In those areas the soils are either derived from greywacke or are dun-coloured bush soils, neither of which provides a favourable substratum, though *Juncus* swamps are common.

Thus fluke is present on limestone and sandstone, but it is absent from peat, andesitic volcanic ash, and bush soils.

## Biology of Myxas and the Fluke.

Pastures are infected with fluke-eggs continuously throughout the year. It has been shown that an individual fluke may survive in the liver for three years, though one year is a more usual length of life. During adult life the fluke does not cease to produce eggs. In Hawke's Bay during the summer and autumn the eggs hatch in two or three weeks according to temperature. In April, however, the time of hatching lengthens, till in May there is practically no development of the embryo. A mean monthly temperature of 50° F. is necessary for appreciable hatching, and the rate of development is directly determined by the mean temperature. Hatching is negligible from May to October in Hawke's Bay.

During the winter *Myxas ampulla* breeds slowly and a considerable mortality of the larger snails takes place. By October the first spring generation of snails is ready for infection with the newly hatched fluke-larvæ. The immature fluke develop during seven weeks in the snail and digest their way out at the end of that period to encyst on the mud or on the stems of *Juncus lampocarpus*.

It would appear that the most suitable time to kill the host snail is before the liberation of young fluke from November onward and after the winter flood waters have receded. It is not advisable to poison the snails when the swamps are at their maximum size since bluestone would be wasted on areas that would not support snails during a dryer period. Any dry spell during August, September, or October would therefore be a suitable time for bluestoning, and similarly in April the swamps are usually well defined and the killing of the intermediate host may be more easily carried out. The use of copper sulphate, however, appears not to be so valuable as it was formerly considered to be. This is due to the facts that the snail requires a considerable concentration to kill it, that much of the copper in limestone country is

precipitated as an insoluble carbonate, and that the eggs and many of the snails living amongst the vegetation never come into contact with the poison. Swamps that have been bluestoned heavily during several years have been found still to carry an infection of *Myxas*. Bluestone is of value in controlling *Myxas* living in choked drains, but it is in no way to be considered as a substitute for draining.

The eggs of the fluke and of the snail are almost unharmed by copper sulphate, so that the effectiveness of the poison is restricted to newly hatched and adult snails. Bluestone is most satisfactorily used by scattering the powder at the rate of 20 lb. to 40 lb. per acre over mud and water-filled hoof-marks in the *Myxas* habitats. There is considerable wastage and small effect from placing bluestone in bags in the course of streams, since, even if there is a swampy area at the side of or in the course of a stream, it is often not directly in the flow of stream water. The bluestone must go on the mud. Copper sulphate has, of course, no ill effects on stock in the concentrations available.

*Myxas* is killed by complete drying for one day, but is able to survive on or in damp mud for several weeks. Its eggs, too, persist on damp mud. In view of the relative inefficiency of copper sulphate in controlling the snail population, draining of swampy areas seems by far the best method of eradicating the liver-fluke. If a drain is dug 2 ft. deep and 2 ft. wide at the top it reduces the amount of water on the mud where *Myxas* lives and within a year has made the locality unsuitable to the snail. Complete drying out is not necessary, and as soon as prolific growth of moss, or an invasion of white clover takes place the drains' function is practically fulfilled. They must, however, be kept as clean as possible with a fast flow of water for at least three years.

The major liberation of flukes from the host snail takes place in late spring and summer. Lambs are found to be infested with mature fluke by the end of January, so that the encysted cercariæ are available on the pasture in numbers by the beginning of December. In suitably moist and cool conditions the cysts are known to survive from one season until the next, but the number of these survivors will be small compared with the number of newly-formed cysts. The survival of infective flukes accounts for cases of black disease outside the usual February to June season. When the fluke cyst has been taken in by the sheep the young fluke burrows through the wall of the intestine and in from five to fourteen days penetrates the liver. As the fluke digests its way through the tissues of the liver a condition is set up in which the spores of the black disease bacillus germinate and commence vegetative growth. The bacterial toxin produced kills the sheep. There is no cure, but prevention of the growth of the bacillus by vaccination before February is possible. In addition, the burning of carcasses and eradication of *Myxas* should be undertaken to prevent a recurrence of the disease.

Within fifty days of the time cysts are ingested the bile-ducts of the liver may contain egg-laying fluke. Thus the young parasite spends at least six weeks in the liver-tissues before migrating to

the bile-ducts. In the mature stage (only) fluke may be removed from sheep by drenching with 1 c.c. of carbon tetrachloride. Any time of the year is suitable for drenching, but it must be remembered that one dose will remove only the adults. So the bile-ducts will receive parasites constantly from the liver-tissues for two months after the first dose even if there is no further infection. This makes further drenchings necessary.

The most useful time, however, at which to administer carbon tetrachloride is late autumn. Drenching in April and June will remove the major infection acquired in summer and autumn. This procedure will prevent the fluke from infesting the pasture with its eggs throughout the winter and relieve the sheep of the parasite burden which might be dangerous during a bad season. Spring and summer drenching should not be neglected in the more seriously infected areas.

| Winter | Spring | Summer. | Autumn. |
|---|---|---|---|
| Few *Myxas*.<br>Few *Myxas eggs*.<br>No fluke-eggs hatch | Fluke-eggs hatch.<br>Infection of snails with fluke.<br>*Myxas* breeding. | Liberation of fluke from snails.<br>Larval fluke in livers of stock | Cysts available on pastures<br>Adult fluke in liver. |
| Drenching.<br>Draining. | Bluestoning of swamps | Vaccination of ewes against black disease.<br>Drenching. | Bluestoning.<br>Drenching. |

The above scheme illustrates the periodicity of the fluke and its host and relates that periodicity to the measures necessary for the eradication of the parasite.

To Dr. C. S. M. Hopkirk, who instigated this work, I am grateful for assistance in experimental infections and for many facilities. Regional officers of the Department of Agriculture lent valuable assistance, and the hospitality of station-owners on the east coast was both useful and greatly appreciated.

# DAMAGE BY SLUGS.

J. MUGGERIDGE, Government Entomologist.

IN connection with the garden slug *Agriolimax agrestis*, the following information culled from the literature should be of assistance :—

The slugs belong to the same division of the animal kingdom as snails, clams, and oysters. They are typically nocturnal in habit, and by far the greater portion of the damage caused by them is carried on at night, in dark, moist, cloudy weather ; however, they remain active throughout the day.

The food habits of the above species are surprisingly variable ; it is almost an omnivorous feeder with a preference for a vegetable diet. Feeding takes place below, at the surface, or above the surface of the soil. Among vegetables Cruciferae seem the favourite host, lettuce, cabbage, and cauliflower particularly, and radishes and turnips to nearly the same extent. Peas, beans, tomatoes, potatoes, and beets are seriously attacked. Among field crops probably peas and beans are more generally injured, though rape, clover, wheat, oats, and many other crops suffer.

Data concerning life-history studies is meagre. The eggs occur at all seasons of the year, but are more common in the spring and early summer. They are placed under stones, boards, and rubbish, under accumulations of grass and weeds, about fence rows and in other moist, shady places. Where natural protection is not available the slugs burrow out a small shallow pit in the surface of the soil with smooth rounded sides and a surface opening. The eggs are laid in clusters of from two or three to fifty or sixty and more. The period from egg to maturity will vary with the season and abundance of food, but is probably from ninety days to nearly a whole year. No data is available concerning average longevity of the slug, though one writer states that the average span is probably from eighteen months to two years.

## Control for Slugs.

### (a) *Climatic.*

Adverse climatic conditions, such as dry, hot weather, drives the slugs into seclusion and tends to minimize injury. Under conditions where plant foliage is luxuriant, however, slugs may find conditions suitable for their depredations—for example, during summer months it is common to find slugs in leafy cabbages or cauliflowers, &c. Excessive rain drives slugs from their seclusion, and frequently they will drown in small pools of water. During cold weather they are likely to remain dormant, but probably cold does not kill them.

### (b) *Natural Enemies.*

Poultry, particularly ducks and geese, seem especially fond of slugs. Several birds, such as the thrush and blackbird, occasionally feed on them. They are attacked by some species of insects, but comparatively little has been done on this aspect of the problem.

### (c) *Clean Surroundings.*

Owing to the habits of the slug in seeking shelter among debris, in long grass, under boards, &c., it will be clear that, following a thorough cleaning-up of all such places, a considerable reduction of the slug population should result. Remove and burn all trash and rubbish when possible. Autumn ploughing should be adopted where practicable and the ground kept clean from weeds.

### (d) *Applied Control.*

The use of quicklime is, of course, an old remedy and quite effective under some conditions. A more recent remedy which has been recommended by some writer consists of dehydrated copper sulphate (bluestone) plus hydrated lime in the proportions of one part of the former to ten parts of the latter. This mixture must be kept in closed cans to avoid dampness. No experimental work has been conducted in New Zealand to determine the relative value of this compound as compared with other "slugicides," but the writer has found it useful in checking an outbreak of slugs found to be infesting field cabbages. The mixture should be applied with a dusting-machine at the rate of 30 lb. to 50 lb. per acre. The best time to apply it is on a warm evening after a drizzling rain or, perhaps better still, in the early morning following moist conditions and at a time approximately when the day is breaking. The effect of the dust on the slugs is to cause profuse salivation and death within a few minutes

# THE AGRICULTURAL YEAR.

## ITEMS FROM THE DEPARTMENT'S ANNUAL REPORT.

THE annual report of the Department of Agriculture was presented to both Houses of the General Assembly recently. It provides a summary of the principal farming activities of the year, and outlines the comprehensive and numerous activities of the Department in its work of maintaining and fostering the growth of the rural industries. The following items of an instructional and informative nature to farmers have been culled from the reports of the Directors of the various Divisions of the Department :—

### JOHNE'S DISEASE.

The evidence accumulated throughout the year shows that this chronic disease of cattle is being reported on several fresh farms from time to time. In the Waikato the disease was confirmed on seven fresh farms during the year, and in Taranaki the disease was shown to exist on ten further farms. Although on many of these farms the actual number of cattle affected with the disease is small, the increase in the number of farms affected, together with the difficulty of knowing the exact extent of the disease in any one district, makes the problem of control of the disease a serious matter. The chronic nature of the disease, with the long period of incubation before clinical symptoms are shown, is a feature of the disease which handicaps the most enthusiastic worker in any survey as to the exact incidence in any district.

In the control of the disease the Johnin test is being availed of by veterinarians in the Taranaki and Waikato districts. In the Waikato district this work is being carried out by Mr. Marshall, assisted by Mr. McDonald. In the Taranaki district Mr. Stephens, Stratford, carried out the intradermal Johnin-testing. The South Taranaki district work in connection with Johnin-testing is now being carried out by Mr. Alexander, Hawera. The slow and exacting nature of this work being carried out and recorded reflects credit on the officers concerned.

A semi-annual Johnin test is being applied to a number of herds, and reactors are being slaughtered. It is hoped in this way to eventually eradicate the disease from such herds. The draining or fencing of swampy areas and subsequent heavy dressing with lime are measures adopted with a view to eradication of the infection from contaminated farms. A series of semi-annual tests must be applied, and some time must elapse before any definite statement can be made.

In order to prevent the spread of the disease it is now necessary to have all dairy cattle intended for shipment to the South Island tested by the double intradermal Johnin test prior to shipment. Although a limited amount of testing in this connection has been done, it is gratifying to know that so far no reactors have been found. This is evidence that the disease is confined to definite areas.

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### MAMMITIS.

The position in regard to mammitis during the year would appear to be less satisfactory. The larger number of cases in many districts

can be attributed to the very variable season with the higher rainfall in the spring and throughout the summer. Under such seasonal conditions the sanitation measures necessary in and about many milking-sheds cannot be maintained, and an increasing number of cows show mammitis as a consequence. In wet seasons there is an increase in the number of cows affected with pox on the udder and general abrasion of the teats, resulting in more cases of mammitis. A high standard of hygiene in the shed is difficult to attain in such a season.

The facilities provided by the Wallaceville and Hamilton laboratories in the examination of milk-samples for farmers are still being availed of and are much appreciated by owners desirous of a means of control. The mammitis-control scheme of the laboratory should be taken more advantage of by farmers as the value of hygienic measures in prevention cannot be given too much importance.

* * * * *

### Contagious Abortion.

This disease of cattle is in the same position as in former years. It would appear that a reduction in the number of outbreaks as compared with the previous season is to be recorded. The control of the disease must be based on hygienic measures adopted in the management of the dairy herd, the isolation of affected animals, and the furtherance of the principle of self-maintenance in regard to replacements in dairy herds.

The testing of blood-samples by the application of the agglutination test is of considerable importance to the owner of the herd and also to the officer who is investigating the disease on affected farms. The control measures to be adopted depend largely upon the result of the blood test showing the extent of the disease in any herd.

* * * * *

### Temporary Sterility.

This trouble has been on a level with previous years. The investigations in regard to the several aspects of the ætiology of the condition of delayed conception in dairy herds are being continued. There is no doubt that delayed conception, as a breeding problem for the farmer, is not due to any specific cause, the female factor, the male factor, the disease factor, and the nutritional aspect all requiring to be further investigated. After investigation of the history of the trouble on many farms at the present time suitable remedial measures can be suggested.

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### Ergotism and "Fescue Poisoning."

In districts where tall fescue is liable to become a rank growth and allowed to form seed heads there is always the danger of animals being affected with ergotism when the farmers use such growth for stock during the winter months of scarcity. There is not the same danger when the fescue growth has been controlled by suitable grazing throughout the season.

* * * * *

### Parasitic Disease in Young Cattle.

Parasitic gastro-enteritis and bronchitis still continue to be a problem for the producer who raises young stock. Many calves on dairy-farms

are lost annually from this disease, and many more are of weak constitution following a severe attack of worms. In many cases weaning takes place too soon or supplementary feed is not supplied to make up for the deterioration in the feeding-value of pasture during the autumn and winter. Better-developed calves with stronger constitutions would result from a more prolonged feeding with milk or other reasonable substitute, and in the rearing of good calves better feeding is the basis of success. The production of stronger, better-constitutioned yearlings would improve the disease position generally in many herds in the course of a few years.

### PARASITIC DISEASE IN SHEEP.

The control of parasitic disease in sheep during the past season has again proved to be very necessary if heavy losses are to be avoided. The unseasonable feed conditions for sheep throughout have made it difficult to carry over hoggets with any degree of immunity from loss. Hogget feeding and wintering is a more or less specialized branch of sheep-farming and unless farmers give special thought and attention to it the results are at times very discouraging. The provision of supplementary feeding in the way of hay, roots, ensilage (and in some cases oats and peas are available) reduces the risk of loss to a very marked extent. It is necessary also to provide a balanced ration wherever possible, as too much watery feed such as roots alone prove of doubtful value. Too much emphasis is often placed on the use of drenches of worm preparations without due attention to the feed conditions. In other cases, although the feed conditions are reasonable, drenching is totally neglected or left until the hoggets become weak and scouring takes place. The instructions given by field officers to drench early and repeat at intervals with a reliable drench such as the copper sulphate-nicotine mixture, and attention to the feed conditions are most satisfactory, and where carried out give very satisfactory results. It is pleasing to record that this drench is being quite generally used in the eradication of worms from infested stock.

### PULPY KIDNEY.

Reports indicate that in the Otago district the losses from this disease were generally below the average of the last two years. In a few instances, however, lambs of an older age were affected with the disease, and this also applied to some losses recorded in the Nelson district.

An extension of the vaccination of the pregnant ewe with a view to conferring immunity on the lambs through the colostrum was organized and carried out by Mr. Dayus, District Superintendent, Dunedin. Mr. Dayus reports: "In all, 2,608 ewes were vaccinated with a vaccine prepared at the Wallaceville Veterinary Laboratory. In addition, observations were maintained on a group of 1,141 ewes, which were vaccinated by farmers, in some cases without help, with a commercial entero-toxæmia vaccine purchased from the Commonwealth Serum Laboratories, Royal Park, Victoria. In all cases a suitable number of control ewes were reserved, which, with the vaccinated ewes, were depastured together. The results briefly show that in the group of 2,608 vaccinated ewes the losses of lambs from pulpy-kidney

disease were eight, whereas in the control group of 2,500 unvaccinated ewes the losses totalled eighty-four, or in other words the losses of lambs from vaccinated ewes were 0·306 per cent., whereas the loss of lambs from the control unvaccinated ewes was 3·36 per cent. In the second trial, using the commercial vaccine, the losses of lambs from 1,141 vaccinated ewes were 22, or 1·92 per cent., whereas the losses of lambs from 2,275 control ewes were 84, or 3·68 per cent."

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### Lymphadenitis.

Although the incidence of this disease in sheep is not so high in New Zealand as in some other countries, it is, nevertheless, a disease which, from a carcass and meat inspection point of view, requires to be kept in check to enable the export of these products to be carried out without any undue restrictions. It has been clearly demonstrated that the regular annual palpation of live sheep will detect affected animals and a continuance of this practice on infected properties over a few years leads to a marked reduction of the disease in infected flocks. Furthermore, the precautions, previously outlined, at shearing-time should be more seriously adopted by farmers in order to reduce the incidence of the disease in the carcass to a minimum. The chronic nature of the disease which allows it to remain undetected in many cases until the carcass is examined for export may account for a lack of interest. Affected carcasses are rejected for export.

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### Lice and Ticks.

The previously recorded system of inspection of flocks inaugurated in the Poverty Bay district has continued to give good results and has reduced the prevalence of lice-infested sheep exposed for sale. More care in dipping is being exercised, and more interest is being taken by the farmer.

The number of prosecutions for exposing lice-infested sheep for sale during the year shows clearly that much improvement is still desirable. There may be some excuse for men with small lots of sheep and no dipping facilities, but, generally speaking, the offenders are not confined to this class alone.

* * * * *

### Development of Pig Industry.

The development that has taken place in the pig industry during the last ten years is displayed by the following figures :—

| Year. | Number of Sows. | Total Pigs killed. | As Baconers. | As Porkers. |
|---|---|---|---|---|
| 1927 .. .. | 69,487 | 380,954 | 268,075 | 112,879 |
| 1928 .. .. | 83,103 | 476,828 | 237,960 | 238,868 |
| 1929 .. .. | 74,692 | 518,025 | 247,292 | 270,733 |
| 1930 .. .. | 61,706 | 515,428 | 255,758 | 259,670 |
| 1931 .. .. | 64,981 | 525,286 | 212,206 | 313,080 |
| 1932 .. .. | 75,409 | 474,094 | 207,096 | 266,998 |
| 1933 .. .. | 87,686 | 635,282 | 243,820 | 391,462 |
| 1934 .. .. | 98,299 | 784,952 | 313,135 | 471,817 |
| 1935 .. .. | 111,793 | 936,700 | 346,948 | 589,752 |
| 1936 .. .. | 116,058 | 1,077,883 | 427,178 | 650,705 |

## WALLACEVILLE POULTRY STATION.

This plant continues to render good service to the industry. The quality of the stock is being maintained, and the introduction of the fresh blood from New South Wales is proving beneficial. The demand for eggs for hatching-purposes, and breeding-birds, by both large and small poultry-keepers is on the increase. Five feeding-tests with some two hundred adult pullets were carried out during the year, and five similar tests with a different lot of birds are being carried out this year. The result of these tests should prove of interest and value to poultry-keepers.

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## HILL-COUNTRY DETERIORATION.

The Superintendent of the Fields Division writes :—

There are two major projects which in the future will require to be given more consideration than has been the case in the past. I refer particularly to the problem of hill-country deterioration in the North Island and the regrassing of the depleted tussock areas of the South Island. The deterioration of hill country in the North Island is a most serious problem of ever-growing intensity, and it is obvious that if steps are not taken immediately to investigate the causes of its deterioration, and, if possible, to effect a remedy, much valuable land which hitherto had a relatively high stock-carrying capacity will be abandoned to fern and secondary growth. Already many settlers have had to abandon their holdings, and others are merely struggling along in a fight against almost overwhelming odds. It would appear that the problem is one largely bound up with the question of such settlers obtaining easy credit for the purchase of seeds, manure, fencing, and stock to combat the weed-intrusion. Large-scale experiments in which I envisage the possibility of the Department taking control of several farms would appear necessary to secure the fullest information of how to rehabilitate this class of country.

So far as the depleted areas of the South Island are concerned, it will be recognized that the large tracts of semi-barren country, particularly in Central Otago and the McKenzie Country, require the closest investigation with a view to increasing their carrying-capacity. At one time these areas carried a wealth of natural pasture affording an abundance of feed for sheep, but with the passing of time, due largely to overstocking, rabbit-invasion, and injudicious burning, the native pastures have been woefully depleted, and to-day large tracts of virtually barren areas exist in place of the excellent native pastures of by-gone days. The striking work of the late Dr. L. Cockayne, who conducted a series of experiments on the Dunstan Mountains, has given a lead to the method by which regeneration of the tussock areas may be effected, but further extensive work in this connection requires to be carried out. The possibility of introduction of grasses and other plants adapted to the soil and climatic conditions of the tussock areas has not yet been fully exploited, and this should be done at the earliest possible opportunity. Proposals to investigate these two major projects are in hand, and it is expected that during the coming season facilities will be forthcoming to fully investigate the position.

### Feed-flavour Investigation.

The following practices are confidently recommended for improving cream-quality, including the reduction of feed flavour, and at the same time increasing production :—

(1) Never hard-graze pastures for long periods, particularly in the winter and early spring. Hard grazing weakens the rye-grass and encourages white clover. Very lenient grazing in the winter and early spring, on the other hand, strengthens rye-grass by increasing its root system and weakens clovers by smothering. A system of long spells between rapid but lenient grazings should be adopted. The adoption of recommendations as above to some extent alter the normal winter feeding of stock, as winter spelling of pastures can only be successfully carried out by commencing feeding out before it really becomes necessary.

(2) Another recommendation is to top-dress in April or May about four good pastures which have been adequately phosphated and limed with sulphate of ammonia at 1 cwt. or 1½ cwt. per acre and lime at 3 cwt. per acre. These fields should be closed to stock and should be only lightly grazed in the late winter and early spring.

(3) Avoidance of the use of "night paddocks" as far as possible should be adopted, because permanent "night paddocks" slow up the "phosphate-clover-stock-nitrogen-rye-grass" process.

(4) In periods of strong feed flavour the most grassy pastures should be grazed during the day and those containing most clover during the night. In addition, cows should be kept oft the clover pastures for about four hours prior to afternoon milking.

(5) Where possible, good hay should be fed when feed flavour is prevalent.

(6) At all times, but particularly in periods of strong feed flavour, attention should be paid to cleanliness and to the cooling of the cream.

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### Artificial Fertilizers.

The practice of top-dressing pastures is a very commendable one, and all officers of the Fields Division are fully alive to the value of bringing about this practice to a greater extent than has been the case in the past, even although an increase in the amount of fertilizer and lime used is being shown from year to year.

In the South Island a definite tendency has been taking place to use basic superphosphate instead of superphosphate for pasture top-dressing. The advocates of this change-over affirm the fact that the results obtained justify the procedure, but, apart from the rights or wrong of this claim, it would definitely appear illogical to first produce a water-soluble phosphate which in the past has proved to be of the highest value for top-dressing purposes and then immediately convert it into a di-calcic form of less solubility. It has to be admitted that southern pastures in the main require liming, and, provided that top-dressing with super-

phosphate is preceded by liming where necessary, there would appear to be little reason in advocating basic superphosphate in place of superphosphate for top-dressing purposes. It is obvious, however, that the claims made for basic superphosphate in preference to superphosphate require the closest investigation, as does the place of basic slag and various citrate soluble phosphates, and investigations in this connection are taking place and will be extended.

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## Creamery Butter.

The Auckland Province continues to maintain its lead in the production of creamery butter, and of the 151,436 tons sent forward for grading, 105,287 tons were graded at the Auckland port, 119,114 tons, or 78·65 per cent., being classed as finest, 30,800 tons, or 20·34 per cent., as first, and 1,522 tons, or 1 per cent., as under first grade. The arrangement whereby all butter of lower quality than first grade is disposed of through a channel which prevents its coming into competition with the higher grades has been continued. On the whole, quality has shown a slight improvement, the average grade for the year being 93·266, as compared with 93·158 for the previous twelve-months.

The scale of prices under the Government's guaranteed-prices scheme has had a bearing on quality, and during the present season butter-manufacturers have aimed at a finished article on which the premium above the basic price is being paid. In addition, some of the advance in quality may be attributed to improved shed, plant, and farm conditions, as well as improvements in respect of dairy factories and plant brought about through the Labour Department's financial assistance by way of subsidy.

Complaints were confined principally to feed flavours and to faulty control of neutralization of acidity in cream. The practice of using starters in buttermaking is extending, and considerable difference of opinion still exists as to the advisability of using starter in the manufacture of butter. It would appear that proper conditions of preparation and considerable experience and skill in the use of starter are necessary before the practice can be safe and success assured.

The growing number of reports from the Division's officers in Britain in respect of foreign matter in dairy-produce, more particularly butter, gives cause for grave concern. The matter has been taken up with dairy companies, but unless the position improves severe steps would appear justified to remove grounds for further complaint. The majority of reports received indicate carelessness rather than accident, and in properly equipped and conducted factories there should be little excuse for either.

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## Cheese.

Some 89,996 tons of cheese came forward for grading, and of this total, 18,806 tons, or 20·90 per cent., were graded as finest, 68,927 tons, or 76·61 per cent., as first, and 2,233 tons, or 2·48 per cent., as under first.

Taken as a whole, cheese-quality for the period under review must be regarded as fairly satisfactory, showing a slight improvement over the previous year. The principal faults are still openness and mould. Starter troubles were less general, though still a major problem in connection with cheese-manufacture. Apart from openness and mould, adverse reports from our London officers relate chiefly to a lack of Cheddar character and an inclination to bitterness, with harsh, mealy bodies. Broadly summed up, however, London reports were encouraging and indicate that New Zealand cheese is well received in Britain and improving its reputation from year to year.

With regard to mould, an experiment was conducted at the Wellington grading-stores to endeavour to ascertain the effect of handling on mould-development, it being considered by some that rough handling of the cheese in the factories was a likely cause. The experiment gave inconclusive results, but served to indicate that if conditions in the curing and storage rooms were properly controlled, mould was unlikely to penetrate even a cracked cheese.

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## Growing of Passion-fruit.

The growing of passion-fruit on a commercial basis has been receiving considerable attention during recent years, more particularly in the North Auckland district. There has, however, been a falling off in the quantity of fruit produced during the past two seasons, due largely to the want of co-operation in the marketing of the produce. Another factor that has contributed to the past season's light crop is the incidence of disease, which demonstrates that it is essential for growers to carry out systematic spraying of the vines, this phase of the work having hitherto been practically neglected.

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## Te Kauwhata Horticultural Station.

The continuous moist weather conditions were favourable to the growth of grass and enabled more than the usual number of stock to be pastured for fattening purposes. From the sales of live-stock, wool, and skins, £401 18s. 5d. was received.

Approximately two and a half acres of scrub and wattle were cleared and sown in grass prior to being planted in vines and three and a half acres of hay harvested for stock-feeding purposes.

A late cold spring and a cool summer retarded growth in the vineyard, and this, in addition to the damage caused by the heavy storm of the previous year, resulted in the season's crop of grapes being considerably below the average. It is estimated that as a result of these unfavourable conditions the quantity of wine produced will not exceed 9,000 gallons, which is a considerable reduction on last year's figures. There has been an increased demand for wine manufactured at the Station, the total sales for the year amounting to 15,125 gallons which realized £8,031. Orders for vines and vine-

cuttings showed an increase, and large quantities were sent out during the season to all parts of the Dominion. The financial position of the Station is satisfactory, receipts exceeding the general working-expenses by some £3,000.

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### Honey Exports.

Quantities and values of honey exported from the Dominion during the last five years ended 31st March are as follows :—

| | Cwt. | Value. £ |
|---|---|---|
| 1933 .. .. .. | 2,005 | 7,014 |
| 1934 .. .. .. | 7,342 | 23,784 |
| 1935 .. .. .. | 5,427 | 17,844 |
| 1936 .. .. .. | 10,446 | 34,258 |
| 1937 .. .. .. | 7,774 | 24,658 |

# DOMINION SHEEP STATISTICS AND CURRENT SLAUGHTERINGS.

THE number of sheep (including lambs) in the Dominion on the 30th April, 1937, totalled 31,305,818 in land districts as under:—

| | | | |
|---|---|---|---|
| North Auckland .. | 1,118,738 | Marlborough .. | 1,130,048 |
| Auckland .. .. | 2,072,366 | Westland .. | 82,311 |
| Gisborne .. .. | 2,343,300 | Canterbury .. | 5,874,467 |
| Hawke's Bay .. | 4,127,594 | Otago .. .. | 3,961,751 |
| Taranaki .. .. | 712,020 | Southland .. | 2,650,908 |
| Wellington .. | 6,791,678 | | |
| Nelson .. .. | 440,637 | Dominion total | 31,305,818 |

The monthly figures of slaughterings at meat-export slaughterhouses and abattoirs since the date given above have been tabulated, and for the period of five months, May to September inclusive, the slaughterings are as follows:—

SLAUGHTERINGS OF STOCK AT MEAT-EXPORT SLAUGHTERHOUSES AND ABATTOIRS FOR THE FIVE MONTHS, MAY TO SEPTEMBER, 1937.

| — | Cattle. | Calves. | Sheep. | Of which Ewes. | Lambs. | Swine. |
|---|---|---|---|---|---|---|
| NORTH ISLAND. | | | | | | |
| Meat-export slaughter-houses— | | | | | | |
| Auckland .. .. | 58,992 | 458,027 | 31,568 | 14,637 | 90,844 | 89,874 |
| Poverty Bay-Hawke's Bay | 14,759 | 31,579 | 83,842 | 20,479 | 98,049 | 12,083 |
| Taranaki-Manawatu .. | 47,389 | 196,304 | 68,760 | 32,018 | 148,365 | 48,365 |
| Wellington-Wairarapa | 18,148 | 21,962 | 84,808 | 31,680 | 89,794 | 14,680 |
| Totals .. .. | 139,288 | 707,872 | 268,978 | 98,814 | 427,052 | 165,002 |
| Abattoirs .. .. | 54,448 | 21,440 | 155,362 | 93,089 | 9,808 | 36,934 |
| North Island totals .. | 193,736 | 729,312 | 424,340 | 191,903 | 436,860 | 201,936 |
| SOUTH ISLAND. | | | | | | |
| Meat-export slaughter-houses— | | | | | | |
| Nelson-Marlborough .. | 169 | 6,456 | 287 | 330 | 22,893 | 2,475 |
| Canterbury .. .. | 9,577 | 21,339 | 123,408 | 102,447 | 549,769 | 14,960 |
| Otago-Southland .. | 6,898 | 24,828 | 37,238 | 33,975 | 417,721 | 1,781 |
| Totals .. .. | 16,644 | 52,623 | 160,933 | 136,752 | 990,383 | 19,216 |
| Abattoirs .. .. | 26,792 | 5,401 | 107,599 | 51,109 | 5,901 | 11,892 |
| South Island totals .. | 43,436 | 58,024 | 268,532 | 187,861 | 996,284 | 31,108 |
| *Dominion.* | | | | | | |
| Meat-export slaughter-houses | 155,932 | 760,495 | 429,911 | 235,566 | 1,417,435 | 184,218 |
| Abattoirs .. .. | 81,240 | 26,841 | 262,961 | 144,198 | 15,709 | 48,826 |
| Grand totals .. | 237,172 | 787,336 | 692,872 | 379,764 | 1,433,144 | 233,044 |

Quarterly returns are received for killings at ordinary slaughterhouses—*i.e.*, rural slaughterhouses—and for the whole Dominion the killings at these places for the first quarter ended 30th June, 1937, amount to:—

| | | | |
|---|---|---|---|
| Cattle .. .. | 22,513 | Lambs .. .. | 2,057 |
| Calves .. .. | 637 | Pigs .. .. | 7,311 |
| Sheep .. .. | 54,253 | | |

# PEDIGREE-SOW RECORDING.

## FIRST ANNUAL REPORT FOR THE YEAR ENDING 31ST AUGUST, 1937.

UNDER the pedigree-sow recording scheme commencing from 1st October, 1936, thirty-eight breeders made use of the departmental service, placing 186 sows under test, and getting 131 completed records. The reasons for the uncompleted records are as follows: Less than four piglets alive, 26; sow dead or not in-pig, 13; withdrawn for other reasons, 10; not weighed, 5. The illness of one of the departmental officers explains the last item. Of the 131 completed records, 28 litters weighed less than 200 lb., 54 between 200 lb. and 300 lb., and 49 were better than 300 lb. at eight weeks.

Twenty-six breeders made use of the Manawatu-Oroua Pig Recording Service, getting 126 completed records. Of the completed records, 35 litters weighed less than 200 lb., 53 between 200 lb. and 300 lb., and 38 were better than 300 lb. at eight weeks old.

Eight breeders made use of the Waikato Pig Recording Club's service, getting 59 completed records out of 72 sows. Of the completed records, 13 litters weighed less than 200 lb., 26 between 200 lb. and 300 lb., and 20 better than 300 lb. at eight weeks old.

These figures converted to percentages give 24 per cent. of all litters recorded at less than 200 lb. at eight weeks, 42 per cent. between 200 lb. and 300 lb., and 34 per cent. better than 300 lb. weight at eight weeks.

The average performances of the different breeds and of all sows recorded is set out in the following table:—

*Table 1.*

| Breed. | Number of Sows. | Pigs born. | Pigs weaned | Average Number of Piglets per Sow. | | Average Weight per Piglet | |
|---|---|---|---|---|---|---|---|
| | | | | Born. | Weaned. | At three Weeks. | At eight Weeks. |
| | | | | | | lb. | lb. |
| Large Black .. | 39 | 376 | 268 | 9·6 | 6·9 | 11·82 | 36·39 |
| Tamworth .. | 162 | 1,509 | 1,125 | 9·3 | 7·0 | 12·15 | 38·05 |
| Large White .. | 54 | 639 | 455 | 10·8 | 8·4 | 12·48 | 38·66 |
| Berkshire .. | 73 | 653 | 528 | 9·0 | 7·2 | 10·97 | 33·98 |
| All breeds .. | 328 | 3,177 | 2,376 | 9·7 | 7·3 | 11·90 | 36·50 |

It is difficult to decide how this information can now be used to best advantage—on the one hand the producers of commercial pigs are anxious to know where prolific and thrifty pigs may be obtained; on the other, it is hardly fair at this early stage to publish all results in detail, since many excellent sows have failed to show their worth, owing to unfortunate happenings that may possibly be avoided in the future. With these considerations in mind it has been decided to publish, under the owner's name, the herd-book number of every sow that attains a certain standard.

Five grades, or standards, have been adopted, as follows :—

*Table 2.*

| Grade. | Litter-weights (Pounds) at | |
|---|---|---|
| | Three Weeks. | Eight Weeks. |
| 1 | Greater than 120 | And 360 |
| 2 | Greater than 100 | And 300 |
| 3 | Greater than 90 | And 270 |
| 4 | Greater than 80 | And 240 |
| 5 | Greater than 70 | And 210 |

Many sows have produced a litter of 70 lb. at three weeks, but failed to do them well up to eight weeks; others have done poorly up to three weeks and done well up to eight weeks. This is a matter for the owner, and since each owner has his records in detail he can take the necessary action to get his sows qualifying if he thinks it desirable. The dual standard may not be a just one, but it seems to be a very desirable one and is simpler than those based on the number of pigs and the weight per piglet at different ages.

In the statement following, the name and address of the breeder is given, followed by the breed and herd-book number of his sow or sows. The single number after each sow denotes the grade of litter produced. This can be interpreted from the previous table. The herd-book number of the sow serves not only to identify the sow, but gives as well a rough indication of her age, for which some allowance should be made when these figures are being considered. Sows tend to have poorer litters after the sixth or seventh. The herd-book numbers allotted to the various breeds from 1932 to 1936 inclusive will be found at the end of this publication. A sow's number appears in the herd book, as a rule, about one year after the sow is born.

*List of Graded Sows.*

| | |
|---|---|
| Barnett, A. L., Leeston, Canterbury | B. 10329, 5. |
| Berry, A. F., and Sons, Rockville, Collingwood | T. 6011, 2; T. 6013, 5; T. 4718, 5. |
| Boland, R. A., Crystal Brook, Longford, Nelson | L.B. 872, 2. |
| Candy Bros., Pokuru R.D., Te Kawa | L.W. 4518, 2; L.W. 4670, 3; L.W. 4362, 3; L.W. 4504, 4. |
| Canterbury Agricultural College, Lincoln | T. 6211, 1; T. 6212, 2; T. 8949, 5; L.W. 4621, 1; L.W. 4765, 2; L.W. 4131, 2; L.W. 4430, 3; B. 10823, 2; B. 11716, 2; B. 11316, 5. |
| Telford, T. W., and Sons, Oakura, Taranaki | T. 8034, 3; T. 7349, 5; T. 5162, 5. |
| Unwin, S., Stoneycroft, Winchester, South Canterbury | B. 10387, 2; B. 10387, 2. |
| Warnock, Mrs. E. M., Hunt's Road, Owaka, Clutha | T. 7645, 4. |
| Wesley College, Paerata, Pukekohe | L.W. 4353, 3; B. 10844, 5. |
| Whitelock, D. P., Normanby, Taranaki | L.B. 892, 4; L.B. 760, 5. |
| Baxter, A. J., Aorangi, Feilding | T. 4156, 2; T. 4156, 5. |

*List of Graded Sows*—continued.

| | |
|---|---|
| Buchanan, D., Tiakatahuna .. .. | L.W. 2951, 2; L.W. 2952, 5. |
| Burmeister, O., Kairanga R.D., Palmerston North .. .. .. .. | B. 8528, 3; B. 8528, 5. |
| Cheetham, S. .. .. .. .. | L.B. 1539, 5. |
| Cheltenham Dairy Co., Feilding .. .. | T. 3304, 1; T. 6763, 1; T. 6761, 2; T. 6764, 2; T. 8681, 3; T. 3304, 5; T. 6761, 5; B. 9344, 3; B. 8578, 4; B. 10297, 5. |
| Christensen, O., Tokomaru .. .. | L.B. 1107, 1; L.B. 1540, 4; L.B. 1314, 5. |
| Clausen, O. V., Foxton Line, Palmerston North .. .. .. .. | B. 9565, 5. |
| Davison, W. .. .. .. .. | L.W. 4215, 2. |
| Fieldhouse, H. E., Rongotea .. .. | B. 10811, 2; B. 10811, 4; B. 10699, 4; B. 10699, 5; T. 2448, 3. |
| Feilding High School, Feilding .. .. | T. 4514, 3; L.B 1519, 4; L.W. 4599, 5. |
| Hansen, N. E., Palmerston North.. .. | T. 6425, 5. |
| Hunt, C. S., Glen Oroua .. .. | T. 5625, 1; T. 3938, 2; T. 5511, 2; T. 8158, 3; T. 3327, 4; T. 3937, 5; T. 5625, 5; B. 11570, 4. |
| Johnston, D. T., Kauwhata .. .. | T. 7573, 4 |
| Keiller, B. E., Palmerston North .. .. | L.W. 3552, 1; L.W. 4459, 1, L.W. 2916, 3. |
| Leamy, P., Kairanga, Palmerston North .. | T. 3928, 4. |
| Lyons, G., Kopane R.D., Palmerston North | B. 10188, 5. |
| Massey Agricultural College, Palmerston North .. .. .. .. | T. 7059, 2; T. 7261, 2; T 7263, 3; T 7261, 4; T. 3615, 4; T. 3101, 4; T. 7059, 4; T. 8834, 4; T. 8518, 4; T. 8833, 5; T. 8836, 5; T 8301, 5. |
| Pedersen, N., Kauwhata, Palmerston North | L.B. 1109, 2, L.B. 1109, 2 |
| Price, R. .. .. .. .. | T, 7516, 2. |
| Russell, J. A., Blythewood, Gillespie's Line, Palmerston North .. .. .. | B. 11369, 4; B. 10035, 5. |
| Scott, W. C., Glen Oroua .. .. | T. 5274, 3; T. 7100, 4; T. 8479, 5. |
| Childs, J. F., Champion Road, Richmond, Nelson .. .. .. .. | L.W. 3752, 2 |
| Clark, A. S., Pokuru, Te Kawa .. .. | T. 5714, 1; T 5714, 2. |
| Cloke Bros., Lepperton, Taranaki .. | B. 11082, 2; B. 10368, 3 |
| Golder, G. A., Nireaha, Eketahuna .. | T. 7375, 2. |
| Gillett, G. E., Sefton, North Canterbury .. | T. 6176, 2; T. 6775, 2; T. 7729, 2; T. 7729, 4; T. 7730, 4; T. 8295, 4; T. 4995, 5; T. 4994, 5. |
| Griffin Bros., Richmond, Nelson .. .. | T. 7755, 5. |
| Guddop, A. R., Cowling Road, New Plymouth | T. 6747, 2; T. 6939, 3; B. 10830, 3. |
| Hoey, J., Kama, Whangarei .. .. | T. 5349, 1 |
| Larsen, O. C., Umutaoroa, Dannevirke .. | B. 10163, 2; B. 11409, 4; B. 11102, 4; B. 11101, 5. |
| Lepper, M. H., York Road, Midhirst, Taranaki .. .. .. .. | L.W. 4550, 1; L.W. 2687, 1; L.W. 3826, 1; L.W. 3825, 2; L.W. 2688, 2; L.W. 4549, 2; L.W. 4647, 4. |
| Mellsop, R., Matatoki, Thames .. .. | T. 7954, 5. |
| Ogle, F., Austin Road, Normanby, Taranaki | T. 7194, 2; T. 5536, 4; T. 5536, 5; T. 3209, 5. |
| Oliver, Mrs. A. B., Kelly Road, Lepperton, Taranaki .. .. .. .. | L.B. 1157, 2; L.B. 1404, 3; L.B. 1271, 3; L.B. 1402, 4; L.B. 1271, 4; L.B. 1158, 5. |
| O'Sullivan, A. M., Cardiff, Taranaki .. | L.B. 962, 1; L.B. 1387, 5. |
| Otago Central Pig-breeders' Club .. .. | L.W. 4641, 2; L.W. 4641, 4. |
| Preston, H. H., Harrisville .. .. | L.W. 3646, 4. |
| Rayner Bros., Patumahoe, Franklin .. | L.W. 4726, 4. |

*List of Graded Sows*—continued.

| | |
|---|---|
| Rose, V. C., Otira R.D., Invercargill .. | L.B. 1234, 4. |
| Simpson, J. S., Southbridge, Canterbury .. | T. 8498, 2; T. 6699, 5. |
| Stewart and Kerr, Onewhero, Tuakau .. | T. 7407, 1; T. 7408, 5; T. 8693, 5; B. 10306, 5. |
| Stratford Technical High School, Stratford.. | T. 7921, 1; T. 7046, 2. |
| Suter, E., Waiau Pa, Pukekohe .. .. | T. 4450, 2; T. 9029, 5. |
| Taylor and Sons, Ngaere R.D., Stratford .. | B. 10772, 1; B. 10772, 2; B. 11808, 4. |
| Whitelock, G. M., Newbury, Palmerston North .. .. .. .. | L.W. 2486, 2; L.W. 4546, 2; L.B. 1265, 2; L.B. 1245, 2; L.B. 1320, 2; L.B. 508, 4. |
| Williams, W. M., Fitzherbert West R.D., Palmerston North .. .. .. | T. 7721, 2; T. 8223, 2. |
| Annett, H. E., Matangi, Hamilton .. | T. 4935, 1; T. 6290, 2; T. 6290, 2; T. 4935, 2. |
| Barton, G. H., Whatawhata, Hamilton .. | T. 5784, 3; T. 4557, 3; T. 7108, 4; T. 5785, 5. |
| Burwen, Ltd., Te Rapa, Hamilton .. | T. 8026, 2; T. 8461, 3; T. 8382, 4; T. 8210, 4; T. 5494, 4; T. Wallinger Sunbeam, 5; B. 11630, 1. |
| Chilcott, R., Te Rapa, Frankton Junction .. | B. 9705, 2; B. 10998, 2; B. 10352, 3; B. 10349, 3; B. 11307, 5; T. 3570, 2; T. 3570, 2. |
| Jones, E. J., Eureka, Hamilton .. .. | T. 6286, 1; T. 6349, 3; T. 6286, 4; T. 8307, 4; T. 8462, 4; T. 8156, 4; T. 8309, 5. |
| Masters, L., Eureka, Hamilton .. .. | L.B. 1417, 4. |
| Parsons, J. E., Pukeroro R.D., Hamilton .. | L.W. 4144, 1; L.W. 4571, 1. |
| Porrit, G. D., Pukeroro R.D., Hamilton .. | L.W. 4154, 1; L.W. 4582, 1; L.W. 4156, 1; L.W. 4156, 1; L.W. 4514, 1. |

*Herd-book Numbers.*

| Year. | Berkshire. | Large White. | Tamworth. | Large Black. |
|---|---|---|---|---|
| 1936 .. | 11858<br>11001 | 4740<br>4557 | 8883<br>7764 | 1513<br>1348 |
| 1935 .. | 11000<br>10292 | 4556<br>4242 | 7763<br>5879 | 1347<br>1131 |
| 1934 .. | 10291<br>9740 | 4241<br>3707 | 5878<br>4191 | 1130<br>874 |
| 1933 .. | 9739<br>9259 | 3706<br>3114 | 4190<br>3323 | 873<br>752 |
| 1932 .. | 9258<br>8851 | 3113<br>2256 | 3322<br>2900 | 751<br>603 |

Montgomery red clover has done very well where used in Southland, particularly as a haying proposition. Where included in permanent pasture mixtures, however, very little is seen after the third year. A noticeable feature is that this plant is not grazed by rabbits, probably on account of its hairy leaf.

# BORERS IN FRUIT-TREES.

L. J. DUMBLETON, Assistant Entomologist, Division of Entomology, D.S.I.R., Nelson.

THE incidence of injury to fruit-trees caused by insects boring into the roots, stem, or branches is not of a very widespread or serious nature in New Zealand, except perhaps in the case of citrus trees. Nevertheless, a number of insects have been recorded as boring in fruit-trees, and it is the purpose of this note to furnish what information is available on their habits and on possible methods of controlling them.

The insects recorded here are native species. One is the caterpillar of a moth and the others are the grubs or larvæ of longhorn beetles. A distinction may be made between those insects which bore into living wood, thus doing serious damage to the tree, and those which bore in wood which is dead and dry and do not usually extend their depredations into the green wood. In the first group come *Charagia virescens*, *Oemona villosa*, and possibly also *Navomorpha lineatum* and *Navomorpha sulcatum*. In the second group come *Xyloteles griseus* and *Xyloteles laetus*.

## DESCRIPTION AND HABITS OF THE INSECTS.

The ghost moth (*Charagia virescens*) is the largest of the native moths, having a wing span of 4 in. or more. The general colour is green with paler and darker markings. The moth itself is not often seen unless it flies into lights in a house. Moths are flying from September to November. The habits of the insect are not well known, but it is assumed that the eggs are laid on the ground and that the young caterpillars hatching from them climb the trees and commence boring in a favourable position. The duration of the caterpillar stage is probably more than three years, and it grows to a length of 3 in. The presence of this insect may readily be diagnosed by the silken web or curtain, resembling the bark in colour, which conceals the mouth of the burrow. Under this is a shallow excavation, and from it a burrow leads off on each side round the side of the limb, while a third burrow extends inward toward the centre of the limb and then vertically downward for perhaps 6 in. In the case of well-grown caterpillars these tunnels may be ½ in. in diameter. The insect, whether in the caterpillar or chrysalis stage, is usually to be found in this vertical burrow. The species is not present in the South Island. A large number of native and exotic trees are attacked by this insect. Injury to fruit-trees is probably more common in districts where patches of bush or native vegetation are close to the orchards. Cases of damage to apple, peach, nectarine, and lemon trees have been recorded.

*The Lemon-tree Borer (Oemona villosa)*.—This longhorn beetle is sometimes known as *Aemona hirta*. The beetle has the long antennæ which are characteristic of longhorn beetles. The body measures up to 1 in. in length and is more or less parallel sided. The general colour is brownish with a clothing of short, golden hair. The life-history of this insect has not yet been carefully studied. The

beetles have been noted to emerge in the spring. The female lays her eggs on dead or exposed wood, such as a branch stub or a place where the bark has been removed. The eggs are affixed to the wood and the young grub bores through the egg-shell and into the wood. Having gained entry through the dead wood, the grub then bores into the living or green wood and commences to make an extensive burrow. The duration of the grub stage is not known, but it is probably more than one year. The grub is similar in appearance to a small "huhu" grub, and when fully grown it may be slightly over an inch in length, cylindrical, white or creamy in colour, and without well-developed legs. Besides boring up or down the centre of the branch the grub frequently cuts a circular burrow round it under the bark and so weakens the branch that it bends or breaks easily. The presence of the insect may be detected by small holes in the bark through which grass or wood particles are ejected. When ready to pupate or transform to the chrysalis stage the larva plugs the tunnel in front and behind it with shreds of wood. In this cell it changes to the chrysalis stage, and a few weeks later the bettle emerges. The grubs of this species are difficult to separate from those of *Navomorpha*, although the beetles are quite distinct. The grubs are found boring in a large number of native and introduced trees and they have been recorded from apple, lemon, and almond trees. Injury by this species seems to be of common occurrence in lemon trees.

*The Douglas Fir Longhorn (Navomorpha lineatum).*—This longhorn beetle is similar in habits to the preceding one. The beetle is easily distinguished. It is dark red in colour, with white stripes. The length of the body is about ¾ in. The beetles are flying from November to January. The grub is similar to that of *Oemona*, but usually longer and more slender. The fully developed larvæ may be 1½ in. in length. The method of gaining entry and the nature of the burrows are similar to that of *Oemona*. The grub of this insect bores into living wood, whereas that of a related species, *Navomorpha sulcatum*, usually bores only in dead wood. *N. lineatum* commonly damages Douglas fir in the North Island, the eggs often being laid on the wounds made by oviposition scars of the cicada. While there is no definite record of the species from fruit-trees it is felt that the species was concerned in a large number of cases of injury which have been attributed to *N. sulcatum*, owing to their similarity in the grub stage.

*The Pine Longhorn (Navomorpha sulcatum).*—This beetle is generally similar to, but smaller in size than, the preceding one, reaching about ½ in. in body length. The red colour is not so distinct and the white stripes occupy relatively more space. The beetles have been recorded as emerging in August. The egg-laying habits are similar to those of the preceding two species, but the grubs seem to confine their activities to dead, dry wood. The duration of the grub stage is not known. The grubs when fully developed may be ¾ in. in length. As far as is known the species does not usually bore in living wood and does not make the circular tunnels under the bark which weaken the branches. This species is found in a number of native and exotic trees and has been recorded from apple and almond trees.

*Xyloteles griseus* has been called the fig longhorn. The beetle is $\frac{7}{16}$ in. in length, brown in colour, with two or three small patches of yellow hairs on each side of the body. The beetles emerge in December and January. The female, with her mandibles, bores a hole in the bark and inserts her egg between the bark and the wood. The grubs bore at first between the bark and the wood, but later enter the wood. The activities of the grub are confined to dead, dry wood. The length of the grub stage is not known. The grub, when fully fed, is slightly over $\frac{1}{2}$ in. in length. It transforms to the chrysalis in a cell in the burrow. This insect bores in a number of native and exotic trees and is sometimes found in mummied apples.

*Xyloteles laetus* is a closely related species of similar appearance and habits to the preceding one.

## METHODS OF TREATMENT.

It is not known whether there are any conditions which predispose a fruit-tree to attack by *Charagia*. It is possible that it may attack perfectly healthy trees. In the case of the longhorn beetles *Oemona* and *Navomorpha*, however, it is known that the point of attack is through dead wood in a pruning-scar, branch stub, or wound. In cases where these insects are commonly present in an orchard it will be advisable to remove all dead wood and seal pruning scars and wounds with some material such as white lead or grafting wax.

Injury by *Charagia* may be readily diagnosed by the silken curtain which covers the entrance to the burrow. In most cases it will be possible to destroy the caterpillar or pupa by probing the burrows with a copper wire. When the operator is satisfied that the caterpillar has been destroyed the openings of the burrows may be sealed with putty or grafting wax and the wound painted over with white-lead. Whenever it is possible, the damaged wood should be cut out of the tree, but it may not be possible to do this in the case of *Charagia*, which is commonly found in the trunk or in large branches.

The burrows of the longhorn beetles *Oemona* and *Navomorpha* are frequently so twisted that it may be impossible to kill the grubs by probing with a copper wire. These two insects commonly attack the smaller branches, and damaged wood may often be cut out. Where it is not possible to cut out the infested wood or to kill the grub *in situ* with a copper wire it may be necessary to inject some insecticide into the burrow. A number of materials have been used for this purpose, but the use of many of them is often followed by injury to the tree, and until more information is available on the effect of the insecticide on the tree it is best to avoid this method of treatment. Calcium and potassium cyanide seem to be definitely unsafe to use as they may kill the cambium and bark above and below the point of application, when injected into a hole or applied to exposed wood. Para-dichlorobenzene also has been reported as injuring trees. These substances mixed with various oils are used to some extent in the United States of America for the control of a longhorn beetle in apple, but they are not applied to exposed wood or injected into the burrows. No information exists on the effect of

carbon bisulphide when injected into the burrows. The use of kerosene and petrol is sometimes advocated for killing grubs, but as these may have a toxic effect they had better not be used. Probably the safest type of insecticide to use is a plant product such as nicotine or derris. Of these two the nicotine is probably more efficient as it may act as a fumigant in cases where the liquid does not actually come in contact with the grub in the burrow. Even in the case of nicotine it is possible that it may have some toxic effect on the plant when injected into the burrows of the grubs.

# PRICE-LIST OF WINES

**made at**

# TE KAUWHATA HORTICULTURAL STATION.

## WINE IN CASE.

**(A case contains 12 reputed quarts—2 gallons.)**

***Delivery ex Departmental Store, Auckland, Wellington, Christchurch, and Dunedin.***

| | |
|---|---|
| FRONTIGNAC (sweet red) | 30s. per case. |
| MADEIRA (sweet white) | 30s. per case. |
| ASSORTED CASES OF THE ABOVE | 30s. per case. |

*Delivery f.o.r. Te Kauwhata.*

| | |
|---|---|
| FRONTIGNAC (sweet red) | 30s. per case. |
| MADEIRA (sweet white) | 30s. per case. |
| CLARET (dry red) | 25s. per case. |

**(Any assortment of the above can be packed to a case if required.)**

## WINE IN BULK.

***(From Te Kauwhata only.)***

**FRONTIGNAC and MADEIRA can be supplied in bulk if required, provided suitable containers are supplied by the purchasers, but not otherwise. (Bottles not accepted; kegs or jars only.) Freight on containers forwarded for filling must be prepaid. Bulk rates are as follows:—**

| | |
|---|---|
| 2 gallons | 10s. per gallon (£1). |
| 5 gallons | 9s. 6d. per gallon (£2 7s. 6d.). |

**(Rates for larger quantities supplied on application.)**

## PLACING OF ORDERS, AND CONDITIONS OF SALE.

**Orders should be forwarded to any one of the following: Manager, Horticultural Station, Te Kauwhata; Director, Horticulture Division, Department of Agriculture, Wellington; District Chief Clerk, Department of Agriculture, Auckland,; District Clerk and Accountant, Department of Agriculture, Christchurch and/or Dunedin.**

**Minimum quantity sold, 2 gallons. Cheques payable to "Department of Agriculture," and crossed "Public Account." Orders cannot be accepted unless accompanied by a remittance covering the price of the wine, and the exchange when drawn on banks outside Auckland, Wellington, Christchurch, and Dunedin. All freight to flag stations and ports beyond the railway must be prepaid. Under the Licensing Amendment Act, 1914, wine cannot be sent into a no-license area excepting on an "order signed by and stating the address and occupation of the purchaser thereof."**

# INTERPOLLINATION OF BRASSICAS.

## ITS SIGNIFICANCE IN RELATION TO SEED-PRODUCTION.

R. A. CALDER, Agronomy Division, Lincoln.

THE intercrossing which may take place between such brassica forms as rape, turnips, and swedes is a matter of some concern to growers who raise these crops for seed and to the merchants who contemplate handling this seed in commerce.

An investigation relative to this phase of seed-production was conducted by the Agronomy Division for the purpose of attempting not only to determine the propensity the three forms have for cross-fertilization, but also to indicate the influence of such on the immediate progeny.

### CROSS-FERTILIZATION STUDIES.

Rape, turnips, and swedes each belong to distinct species or subspecies, and, although to some extent capable of self-fertilization, set seed more freely consequent upon cross-fertilization between individuals of the same species.

Cross-fertilization may also operate in certain instances between distinct species. Sutton(1), in reference to interspecific crosses, which he himself carried out, proved that " while no variety derived from *Brassica oleracea* (cabbage, thousand-headed kale, kohl rabi) was affected by the pollen of rape, swede, or turnip, and *vice versa*, yet all types of *B. oleracea* would freely intercross between themselves, and this was equally true of many varieties of rape, swede, and turnip."

Roemer(2) crossed swedes (" *Rutabaga - Brassica Napus rapifera* ") with kales and cabbages (*B. oleracea*). Fertile hybrid plants were obtained when the swede was used as the female parent; no successes were secured from reciprocal crosses.

Nelson(3) mentions the work of a number of investigators who acknowledge the ability of rape, turnips, and swedes to intercross, but from his own work concludes that differential fertility is to be found between these forms.

The evidence obtained from trials conducted by the Agronomy Division is in accordance with the views of Sutton and Nelson.

The forms used in the investigations were :—

(1) Rape (*Brassica napus* L.).
(2) Turnip, white flesh (*B. rapa* L.).
(3) Swede, yellow flesh (*B. napobrassica* Mill.).
(4) Wild turnip (*B. campestris* L.).
(5) Chou moellier or marrow-stemmed kale (*B. oleracea* L.). This was included as it is an important farm crop belonging to the species *B. oleracea*.

These were cross-pollinated reciprocally by hand; wild turnip was used as the male parent only. The results are recorded in Table I.

*Table I.—Shows the Response in Number of Pods formed and in Number of Seed set due to Interpollination of some Brassica Species.*

| Female Parent. | Male Parent. | Flowers pollinated. | Number of Pods formed. | Number of Seed set | Percentage of Pods set. | Average Number of Seed per Pod. | Appearance of Seed. |
|---|---|---|---|---|---|---|---|
| Giant rape .. | Turnip .. | 40 | 34 | 41 | 85·0 | 1·2 | Well developed, good colour. |
| | Swede . | 96 | 69 | 767 | 72·0 | 11·1 | Ditto. |
| | Wild turnip . | 30 | 20 | 80 | 66 6 | 4·0 | ,, |
| | Chou moellier | 56 | 23 | 0 | 41 0 | 0 | .. |
| Broad-leaf Essex rape | Turnip .. | 42 | 31 | 131 | 73·9 | 13·9 | Well developed good colour. |
| | Swede .. | 65 | 58 | 932 | 89 3 | 16·1 | Ditto. |
| | Wild turnip .. | 31 | 22 | 77 | 71 0 | 3·5 | ,, |
| | Chou moellier | 18 | 0 | 0 | 0 | 0 | .. |
| Turnip .. | Giant rape . | 27 | 16 | 154 | 59 3 | 9 5 | Shrivelled, reddish colour; tendency to germinate in pod; seed-coats split |
| | B.L.E rape . | 32 | 19 | 277 | 59 4 | 14 6 | Ditto. |
| | Swede .. | 192 | 140 | 1,021 | 73·0 | 7·3 | ,, |
| | Wild turnip .. | 35 | 35 | 373 | 100 0 | 10·7 | Well developed, good colour. |
| | Chou moellier | 94 | 0 | 0 | 0 | 0 | |
| Swede . | Swede .. | 1,048 | 768 | 12,441 | 73 3 | 16 2 | Well developed, good colour |
| | Giant rape | 96 | 86 | 1,659 | 89·6 | 19·3 | Ditto |
| | B.L.E. rape | 103 | 93 | 1,945 | 90·2 | 20·9 | ,, |
| | Turnip | 169 | 104 | 1,358 | 61·6 | 13·0 | ,, |
| | Wild turnip . | 39 | 27 | 71 | 69·2 | 2·6 | Most well developed, good colour, some shrivelled |
| | Chou moellier | 60 | 23 | 0 | 38 6 | 0 | . |
| Chou moellier or marrow-stem kale | Chou moellier | 255 | 162 | 3,189 | 63·6 | 19·7 | Well developed, good colour. |
| | Self-pollinated | 281 | 127 | 246 | 45 2 | 2·0 | Ditto |
| | Giant rape . | 64 | 23 | 0 | 36·0 | 0 | |
| | B.L.E. rape . | 51 | 16 | 0 | 31·2 | 0 | .. |
| | Turnip . | 89 | 57 | 0 | 64·0 | 0 | |
| | Swede .. | 191 | 75 | 0 | 39 3 | 0 | |
| | Wild turnip .. | 43 | 5 | 0 | 11·6 | 0 | .. |

*Comments on Table I.*

(1) It may be noted that some seed has been obtained from all crosses, with the exception of those where chou moellier has been used as one of the parents. Rape, turnip, and swede may be readily cross-fertilized.

(2) With seed or rape as the mother plant the seed harvested was well developed and of a good, dark colour, with turnip as the mother plant the seed was shrivelled, of a poor reddish colour, and tended to germinate in the pods; the seed-coat in many cases was split.

Somewhat similar observations were recorded by Sutton and Nelson.

(3) In some of the chou moellier crosses pods developed, but contained no seed This fruitfulness accompanied by sterility is by no means unusual. Nelson draws attention to the occurrence and terms the seedless fruits "false pods."

(4) Wild turnip crosses readily with all forms excepting chou moellier. The seeds per pod are generally few, but they are well developed.

(5) Chou moellier exhibits some degree of sterility when selfed. Crossing resulted in 19·7 seeds per pod, selfing in 2·0 seeds per pod.

These results were obtained when the different types were artificially interpollinated. As it was of interest to determine whether cross-fertilization could occur naturally, the following procedure was adopted :—

## *Natural Cross-pollination.*

Rape, turnip, and swede plants were grown in close association, and for a period all flowers, other than those covered subsequent to hybridization, were exposed and available for interpollination; this

was possible between members either of the same or of distinct species. The pods which developed from these flowers were harvested separately, and in the following season the seed was sown to determine, as far as possible, the degree of natural interspecific pollination which had occurred. The following results were obtained :—

(*a*) From swede open-pollinated in the presence of rape and turnip, sixty-three plants attained full development ; of these, twenty-five were recognized as Swede × Rape, the balance resembling pure swedes.

(*b*) From turnip open-pollinated in the presence of swede and rape, twenty-five plants attained full development. Of these, seventeen resembled the Turnip × Swede, and eight the Turnip × Rape hybrids. Only one turnip plant had in the previous season reached the flowering-stage. As this one plant failed, unaccountably, to produce seed on self-pollination, it follows that all seed formed must necessarily have arisen as a result of pollination by other species.

(*c*) From rape open-pollinated in the presence of swede and turnip, fifty-five plants attained full development ; all resembled normal rape.

Although no definite explanation can be offered for the non-appearance of turnip hybrids in (*a*) or for the apparent absence of any hybrid plants in (*c*), it is evident that when rape, turnips, and swedes are grown in close association a certain amount of natural cross-pollination can occur. No evidence was obtained as to what the extent would be, consequent upon wider spacing. English seed firms advise at least a quarter of a mile between distinct species or varieties.

## Hybrid Forms.

Crops grown from commercial seed of rape, swede, and turnip are, as a rule, remarkably free from types indicative of contamination by "foreign" pollen. Nevertheless, such off-types are occasionally observed, and a knowledge of the appearance of hybrid forms of known parentage should be helpful to the seed-grower in enabling him to identify such plants.

Before describing the various hybrid forms, mention should be made of the manner in which certain characters are transmitted ; such information may prove to be of some use in determining the probable source of "foreign" pollen and in indicating the precautions that must be made in future years.

Rapes, swedes, and turnips each possess certain characteristics which serve to distinguish them.

*Table II.—Some Distinguishing Characteristics of Rape, Swede, and Turnip*

| Species. | Skin-colour. | Flesh-colour. | Flower-colour. |
|---|---|---|---|
| Rape— | | | |
| Giant .. | White .. .. | White .. | Bright lemon-yellow. |
| B.L.E. .. | White .. .. | White .. | Paler yellow than giant. |
| Swede .. | Purple .. .. | | |
| | Bronze .. .. | (1) White | Bright lemon-yellow. |
| | Green .. .. | (2) Yellow | Dull buff-yellow. |
| Turnip .. | White .. .. | | |
| | Green .. .. | (1) White | Bright lemon-yellow. |
| | Red .. .. | | |
| | Purple (green + red).. | (2) Yellow | Dull buff-yellow ; paler than swede. |

When two individuals possessing contrasting characters are crossed the immediate or first progeny will generally exhibit only one of these characters; that observed in the first generation is referred to as the dominant character.

The observations made at this Station confirm those made by Davey(4), and may be summarized as follows :—

(1) White flesh is dominant over yellow flesh.

(2) A bright lemon-yellow flower-colour is associated with white flesh, and a dull yellow-buff colour with yellow flesh. In a flowering crop, therefore, it is sometimes possible to locate

FIG. 1. LINCOLNSHIRE RED TURNIP × GRAND MASTER SWEDE. SHOWS FORMATION OF HYBRID NODULES NOT CLUB-ROOT.

certain rogues by flower-colour; bright lemon-yellow flowers indicate roots with white flesh, and yellow-buff flowers roots with yellow flesh.

(3) Green skin-colour and red skin-colour are independent of one another, but when associated together in the one plant produce a purple effect. By scraping away the red of purple roots the green may be observed beneath. Both green and red are dominant over white skin.

(4) An additional point of interest is that the roots of hybrids obtained by crossing turnips and swedes are characterized by irregular knoblike swellings similar in appearance to those caused by the disease known as "club-root." They are termed hybrid nodules (Fig. 1).

The practical significance of these facts will be appreciated by an observer when endeavouring to determine the probable source of pollen-contamination.

### Appearance of Hybrid Forms.

(Note.—In each cross the mother plant is mentioned first.)

#### 1. (*a*) *B.L.E. Rape* × *Yellow-flesh Swede.*

*Foliage.*—Abundant, rape-like in appearance, dense, and erect; short central stalk with numerous side branches. Leaves: Similar to those of rape. Colour: Greyish-blue, green.

FIG. 2. TOP LEFT, GRAND MASTER SWEDE; TOP RIGHT, BROAD-LEAF ESSEX RAPE; BOTTOM, SWEDE × RAPE.

*Bulbs.*—Slightly developed, misshapen, and very fangy. Flesh: White or greyish in colour and rather woody. No colour in exposed surface. A pronounced neck is evident, the scars of which are slightly tinged with purple, as are the bases of the side stalk. No marked development of nodules.

*Flower-colour.*—Yellow.

#### 1. (*b*) *Yellow-flesh Swede* × *B.L.E. Rape* (Figs. 2 and 7).

*Foliage.*—Varies between that of rape and swede; greyish-blue-green in colour with the stalks in some cases tinged with purple. Shape and appearance of leaf also varies between that of rape and swede.

*Bulbs.*—Small to medium sized, generally uniform in shape, but extremely fangy. Flesh: White in colour and woody. No colour in

exposed surface. A pronounced neck, the upper scars of which are coloured purple, as are also the bases of the side stalks. No appearance of nodules.

*Flower-colour.*—Yellow.

2. (*a*) *Yellow-flesh Swede* × *White-flesh Turnip* (Figs. 3 and 7).

*Foliage.*—Intermediate in appearance between that of both parents, the colour of some plants tending more towards the bright-green colour of turnips, while that of others is the greyish tinge of swedes. Shape of leaf and habit of growth are more like those of swede than of turnip.

FIG. 3. TOP LEFT, GRAND MASTER SWEDE; TOP RIGHT, LINCOLNSHIRE RED TURNIP; BOTTOM LEFT, TURNIP × SWEDE; BOTTOM RIGHT, SWEDE × TURNIP.

*Bulbs.*—Medium size, misshapen, fangy, slight neck-development. Flesh: White in colour and firm in consistency. Exposed surface: Generally without colour. Neck scars: Usually purple. Small bulbous nodules similar to those of club-root, but identified as not being such, are present on the roots; are termed hybrid nodules.

2. (*b*) *White-flesh Turnip* × *Yellow-flesh Swede* (Fig. 3).

*Foliage.*—Rather abundant, tending more towards the appearance of turnip than of swede; bright-green in colour, with shape and habit similar to those of turnip.

*Bulbs.*—Medium to large, misshapen, fangy, with slight neck-development. Flesh: White in colour and of a firm consistency. Exposed surface: Purple in colour with an uneven green band round lower margin. Neck scars: Purple; this colour is continued as a tinge into the stalks. Marked nodule development (Fig. 1).

*Flower-colour.*—Yellow.

3. *White-flesh Turnip* × *B.L.E. Rape* (Figs. 4 and 7).

*Foliage.*—Short, dense, bright-green in colour, similar to rape in habit, but with colour of turnip. Leaves: Medium length, rather narrow, with fair lobe-development; no colour in stalk.

*Bulbs.*—Practically no development; only a small woody swelling; very fangy. Flesh: White in colour. No colour in exposed surface. A short stout neck, from which numerous side stalks arise. No nodule development.

*Flower-colour.*—Yellow.

FIG. 4. TOP LEFT, LINCOLNSHIRE RED TURNIP; TOP RIGHT, BROAD-LEAF ESSEX RAPE; BOTTOM, TURNIP × RAPE.

4. *Yellow-flesh Swede* × *Wild Turnip (white flesh)*, (Figs. 5 and 7).

*Foliage.*—Scanty but vigorous, intermediate in appearance between swede and wild turnip, but tending more towards the wild turnip. Leaves: Rather large, semi-erect, and much lobed. Stalks: Purplish-red in colour.

*Bulbs.*—Medium to large in size, generally a little flattened, being wide from side to side in one direction; set rather deeply in the ground; very fangy. Flesh: White in colour, with a firm consistency. Exposed surface: Reddish-purple in colour, with a slight green band. Neck-development variable, scars purple, which colour is continued on into stalk. Distinct nodule development.

*Flower-colour.*—Yellow.

5. *White-flesh Turnip* × *Wild Turnip (white flesh)*, (Figs. 6 and 7).

*Foliage.*—Prostrate and bright-green in colour. Leaves of a medium size and much lobed; stalk purplish. A few plants developed seed-stalks.

*Bulbs.*—Development poor; small to medium size, misshapen and fangy. Flesh: White in colour, with a firm fleshy to woody consistency. No colour in exposed surface. Practically no neck. Scars of crown tinged with purple, which colour is continued into stalks. Distinct nodule development.

*Flower-colour.*—Yellow.

FIG. 5. TOP LEFT, GRAND MASTER SWEDE; RIGHT, WILD TURNIP; BOTTOM LEFT, TWO ROOTS OF SWEDE X WILD TURNIP.

## Application of the Results.

It is evident that cross-pollination with subsequent fertilization can be effected quite readily between rape, turnips, and swedes. The results, however, afford no definite indication as to the actual contamination which may occur in the field when two or more distinct forms are grown within short distances of one another. Under these conditions certain limitations may influence the issue:—

(1) The forms may flower at different times. If there is no overlapping of the flowering periods no cross-pollination can occur.

(2) Generally speaking, the pollen from plants of a certain form is more effective on individuals within that form than on those of a different form.

(3) When an area consists of numerous plants of one form all growing in close association the superabundance of the "home" pollen should restrict the effect of "foreign" pollen.

(4) The prevailing wind may predispose the flight of insects carrying pollen to a particular direction.

FIG. 6. TOP LEFT, LINCOLNSHIRE RED TURNIP. OTHER SPECIMENS REPRESENT A RANGE OF TYPES OBTAINED FROM TURNIP × WILD TURNIP; THE WILD TURNIP PARENT HAS NOT BEEN INCLUDED.

Despite these limitations and in view of the fact that hybridization can and does occur, distinct forms and varieties when grown in the same vicinity should always be strictly isolated one from the other. If such a precaution is taken, and provided any casual wild turnips are eradicated, a grower can be more definitely assured of producing a seed crop, the progeny of which should exhibit a satisfactory degree of purity.

## Conclusion.

Interspecific cross-pollination, with subsequent fertilization, can be effected artificially, and also takes place naturally between rape, swedes,

turnips, and wild turnips. The progeny of these inter-relationships is generally inferior to the parental forms, and consequently in the production of these seeds every effort should be made to prevent the incidence of foreign pollen. No seed was obtained when chou moellier was crossed with any of the above forms.

FIG. 7. TOP LEFT, SWEDE × RAPE; TOP RIGHT, TURNIP × RAPE; MIDDLE LEFT, SWEDE × WILD TURNIP; MIDDLE RIGHT, TURNIP × WILD TURNIP; BOTTOM, SWEDE × TURNIP.


## ACKNOWLEDGMENT.

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# FRUIT-CROP PROSPECTS.

THE Director of the Horticulture Division has received the following reports from his officers regarding the fruit-crop prospects at the end of October, 1937:—

*Auckland*.—Apples: Heavy blossoming and a good setting Gravensteins light. Lemons: Blossoming freely. Nectarines: Poor setting. Oranges: Poorman blossoming freely. Peaches: Light setting. Pears: Heavy setting most varieties. Plums: Generally light. Strawberries: Medium crop. Rain needed. Tomatoes: Hothouse good crops. Heavy plantings of outdoor varieties.

—*L. Paynter.*

*Tauranga*.—Apples: Dunn's and Dougherty patchy. Promise of good average crop other varieties. Apricots: Light to very light. Gooseberries and pears: Good. Lemons: Promise of good main blossoming. Oranges: Good blossoming. Nectarines and peaches: Light. Plums: Average to good. Tomatoes: Average plantings; both outdoor and under glass definitely backward.

—*A. R. Grainger.*

*Hamilton*.—Apples: Satisfactory blossoming on most varieties. Gooseberries: Heavy. Lemons: Promise of good blossoming for main crop. Peaches: Heavy blossoming all varieties. Pears: Heavy blossom. Plums: Excellent blossoming. Plums (Japanese): Heavy blossoming and setting. Strawberries: Prospects of average crops. Grapes: Outdoor Vines moving away well.

—*R. G. Hamilton.*

*Gisborne*.—Apples: Indications crop will be generally heavy. Apricots, nectarines, and peaches: Average to heavy. Gooseberries, plums, and walnuts: Average. Lemons: Main winter crop now harvested. Oranges: Indications are for heavy blossoming. Pears: Heavy. Strawberries: Light. Tomatoes: Plants backward due to cold temperatures.

—*P. Everett.*

*Hastings*.—Apples and pears: Heavy crops all varieties. Apricots, cherries, gooseberries, raspberries, strawberries, and walnuts: Average. Lemons and oranges: Moderate bloom. Nectarines: Reduced heavily in some areas through frost. Peaches: Some varieties reduced by frost in parts, but heavy district yield expected. Plums: Heavy. Plums (Japanese): Some varieties reduced by frost in parts, but good district yield expected. Tomatoes: Heavy plantings.

—*N. J. Adamson.*

*Palmerston North*.—Apples and pears: Indications point to heavy setting. Apricots: Very light setting owing to late frosts. Cherries and nectarines: Very light setting. Gooseberries: Good average crop. Peaches and plums: Patchy to light setting. Raspberries: Good promise; not many grown. Strawberries: Well forward; promise well. Tomatoes: Outside plants backward; many killed by frost.

—*J. W. Whelan.*

*Masterton*.—Apples: Abundant blossoming most varieties. Apricots: Very light crops expected owing frost injury. Cherries: Good blossoming, light crop. Gooseberries: Good to heavy. Nectarines, peaches, and plums: Very light. Pears: Fair crops. Raspberries: Canes looking very well; well furnished for time of season. Strawberries: Abundant bloom, fruit setting well. Tomatoes: Looking well under glass. Outdoor planting not commenced.

—*M. Davey.*

*Nelson*.—Apples: Very heavy blossoming of nearly all varieties. Apricots: Moderate crop. Cherries and raspberries: Good crops anticipated. Gooseberries: Good crop. Lemons: Moderate crop anticipated. Nectarines: Good crops where no frost damage was suffered. Peaches: Moderate to good crop expected. Pears: Winter Coles patchy in places. All other varieties showed very heavy blossoming.

Indication of moderate to good crop. Plums: Moderate to good crops showing. Strawberries: Good crops anticipated. Rain badly needed. Tomatoes: Indication of good crops in glasshouses. Outdoor planting almost completed.

—*R. E. Binfield.*

*Mapua.*—Apples: Heavy blossoming of practically all varieties. Cox's Orange and Jonathan varieties exceptionally heavy. Sturmers patchy. Delicious in places do not appear to be setting well. Weather conditions not favourable to development. Pears: Good blossoming of all varieties. Winter Coles appear to be setting light; other varieties fair to good.

—*A. T. Douglas.*

*Motueka.*—Apples: All varieties blossomed heavily. Good set of fruit. Apricots: Fair set. Cherries: Heavy blossoming. Gooseberries: Up to average. Nectarines: Good average crop set. Peaches: Showing well; signs of good crop. Pears: Good setting of fruit all varieties. Plums: Fairly good, especially where not damaged by frost. Raspberries: Canes coming into good growth. Strawberries: Good crops showing at present Tomatoes: Outside plantings almost finished.

—*G. Stratford.*

*Blenheim* —Apples: Present indications are for a heavy crop of all varieties, except Cox's and Dunn's, which are light. Apricots: Average to heavy. Cherries, peaches, and raspberries: Indications are for average to heavy crops. Gooseberries and strawberries: Crops generally heavy. Nectarines: Average to heavy crop set. Pears: Crop most varieties light. Plums: Crops generally average to light. Plums (Japanese): Average to light crops showing. Tomatoes: Average to heavy crop of hothouse. Outdoor damaged by frost, and a certain amount of replanting will require to be done. Walnuts: Crops light due to frost injury.

—*D. J. Hogg.*

*Christchurch* —Apples: At present prospects of heavy crops of all varieties. Apricots: Medium to light. Cherries: Prospect average crop. Gooseberries: Medium to heavy. Nectarines: Medium crops except where damaged by frost. Peaches: Average crops except where damaged by frost. Pears: Prospects of heavy crops of all varieties. Plums: Medium to heavy except where damaged by frost. Plums (Japanese): Heavy crop. Raspberries and strawberries: Prospects of medium to heavy crops. Tomatoes: Under glass, average crops. Walnuts: Medium crop where not damaged by frost.

—*B. G. Goodwin.*

*Dunedin.*—Apples: Heavy blossoming all varieties other than Jonathan affected by frost. Apricots: Slightly below average due to frost. Cherries and gooseberries: Average. Nectarines, pears, and plums: Below average. Pears: Severely reduced by frost. Strawberries: Reduced by frost. Walnuts: Affected by frost.

—*G. H. McIndoe.*

*Alexandra.*—Apples: Very heavy blossoming all varieties. Apricots: Average set. Cherries, nectarines, peaches, and pears: Very heavy set. Plums: Very heavy blossoming; drop now occurring which may reduce crop very considerably. Strawberries: First flowers frosted; later crop heavy. Tomatoes: Now commencing to plant out. Walnuts: Heavy set, but some frosted.

—*W. R. L. Williams.*

# SEASONAL NOTES.

## THE FARM.

### Importance of controlling Pasture-growth in Summer.

The importance in respect to the nutrition of stock of preventing, as far as practicable, the development of stemminess in pastures was discussed in these notes last month. To sum up the position, "wet" stock—*i.e.*, cows, sows, and breeding-ewes—are capable of heaviest production, which normally is most economical production in respect to feed-consumption; young stock growing at the quickest rate of which they are capable normally are next in order of heavy production. The heavier the production the greater is the need for leafy pasture growth, with its greater digestibility; its greater content of mineral matter, which is required for the formation of milk and bone; and its greater content of protein, which is required for the formation of milk and flesh. The rations of wet and growing stock are in summer often below full requirements in respect to digestibility, mineral content, and protein content.

Apart from the quality of the feed, an additional advantage of maintaining pastures in a leafy condition is that to do so prolongs the period of their growth. The more pastures are allowed to become stemmy in summer the more do they appear to exhaust themselves in the development of flower-heads, and certainly they assume a condition of low production of leafage during a considerable and critical part of the season of farm-stock production—that is, during late summer and early autumn. On the other hand, pastures in which flower-head development has been minimized have a correspondingly greater tendency to continue the production of leafy herbage right through the season.

Still another advantage of avoiding stemmy growth in pastures as much as possible is the fact that swards which are allowed to become tall tend to become undesirably open and certain valuable species may be weakened by taller-growing competitive species in the sward.

Important means of maintaining leafiness in pastures during summer were set down in these notes last month. Further to last month's notes, for the purpose of stimulating fresh leafy growth in the latter part of the summer, at times it may be advantageous to top-dress some of the pastures of a farm with superphosphate in early summer. Observation in the field points to the conclusion that such top-dressing is most effective in districts in which a good deal of rain falls in December and January. As such rainfall decreases, top-dressing declines in effectiveness as a means of obtaining additional late summer leafy feed until a point is reached when its influence upon the summer leafiness of pastures is negligible. Areas from which hay or silage has been saved often profitably may be top-dressed in December with superphosphate, which tends to increase the production of leafy feed later in the summer, when such feed frequently is in scant supply and therefore particularly valuable. It has been found that later on the influence of phosphates applied about mid-summer approximates that of identical fertilizer applied in the autumn.

The facts about the summer control of the growth of pastures given herein and in the last month's notes have long been known; the economic value of their application has been demonstrated strikingly by certain progressive grass-farmers. But, despite the fact that their pastures could be kept in a much more leafy condition during summer

without any great outlay or effort, a great many farmers do nothing year after year to improve their inefficient summer control of the growth of their pastures.

### Lucerne Culture.

As a rule, in many districts best results are obtained by sowing lucerne in the latter part of November or in December. Sometimes in favourable seasons or other favourable conditions, such as location, good results are obtained by earlier sowing. The basic fact that should be reflected in practice is that the ultimate success obtained with lucerne depends to a considerable extent upon the rapidity of its growth in its infancy, which in its turn, when supplies of moisture and plant-food are adequate, is determined by the warmth of the soil. Hence, as a rule, there is no justification for taking the risk of slow initial growth due to early sowing, unless it is expected that dry conditions will be experienced in late summer before a crop sown late in November or in December has become safely established Special circumstances may justify late summer or autumn sowing, which sometimes is quite successful; but in the milder districts in which certain of the plants which commonly invade lucerne make some growth, even if but little, practically through the winter, late summer or autumn sowing of lucerne usually is unsuccessful, except when much tedious weeding is carried out to prevent the smothering by the invading plants of the lucerne seedlings at a standstill in their growth during the winter

A fine, firm seed bed contributes to rapid, vigorous establishment of seedlings and is essential for best results Good results follow sowing 12 lb. to 18 lb an acre of seed through every coulter of a grain-drill; the poorer the preparation of the seed-bed, the more seed is required. Broadcasting of the seed and covering it by light harrowing is an alternative practice which as a rule gives results not quite as good as drilling Generally, lime may be applied profitably before the final cultivation preceding seed-sowing, and the application of phosphates at or about the time of seed-sowing is, as a rule, distinctly beneficial to net returns. Inoculation, the importance of which is noted subsequently herein, may not take place if superphosphate comes in contact with the seed and nullifies inoculating treatment—this undesirable effect may, however, be avoided by not sowing seed and superphosphate mixed together. When it is desired to sow seed and fertilizer mixed together this may be done safely by using an insoluble fertilizer such as basic slag or by sowing the seed with carbonate of lime and superphosphate mixed in equal proportions for about a week before bringing the seed in contact with the mixture.

Lucerne, in common with other legumes such as peas and clovers, works in partnership with certain soil bacteria. The legume helps the bacteria by furnishing them with a home and food, but the bacteria are so helpful to the legume by supplying it with nitrogen, which they get from the air, that they are essential for full thrifty development of the legume. Different legumes work in partnership with different strains of bacteria, and there is no way which can be used by farmers before growing the crop of discovering whether the soil contains sufficient numbers of the organism suitable for a specific crop. Although the organism needed for full success with lucerne is present in some soils in adequate supply, in other soils it is not so, and hence the safest course is to supply the organism artificially. This is called soil inoculation. Field experience shows that in various districts throughout New Zealand poor past results with lucerne have been due primarily to the absence of the particular organisms with which lucerne works in partnership. Supplies of the bacteria are called cultures and may be bought from the Department of Agriculture at a cost of approximately 1s. for the treatment of the seed sufficient for an acre.

Often lucerne should be mown in November or December. If the weather is unfavourable to the production of good hay the lucerne may be used for ensilage. Should the amount of lucerne available be too small to allow of ensilage without undue waste, then it may be saved, together with green material from the pastures or from such a crop as green oats. The making of good lucerne hay calls for care designed to avoid the loss of leaves, which readily occurs if handling is faulty. The mown material should not be left in the swathe to dry sufficiently to allow of direct carting to the haystack—this would result in the leaves, which are much more nutritious than the stalks, becoming dry and brittle and in many of them being lost during carting in. To avoid such serious loss lucerne hay should be cocked. Lucerne hay fairly often is stacked before it is dry enough—this is probably so because the stems do not become dry enough as quickly as do the leaves.

Lucerne should be mown when new shoots are just starting from the crowns or bases of a considerable number of the plants. As a rule, when new shoots have so developed about a quarter of the plants are in the early-flowering stage, but as this is not always true, reliable guidance about the time to mow is not provided by observation of the flower-development.

### General Cropping.

Good farmers in most districts become very busy with special cropping work in November and December.

Of the crops generally sown at this season the swede is of outstanding importance. Partly as a means of reducing the ravages of diseases such as club-root and dry-rot, swedes are almost always sown on land ploughed out of grass, and records relative to farmers' field competitions definitely point to the advantages of this practice. Over wide areas successful results may be expected from sowing swedes in December at the rate of 10 oz. to 14 oz an acre. Sowing through every second coulter of an ordinary grain-drill is probably most popular, but sowing through every coulter has often given good results, and, especially in the South Island, sowing in ridges followed by intertillage also consistently has given good results. The popularity of varieties of swedes differs greatly from one district to another; in the southern portion of the North Island Superlative, Majestic, and Grandmaster have proved popular, while in Southland, Elephant and Masterpiece seem to have been favoured considerably. It now is common practice in districts of good rainfall to use 2 cwt. to 3 cwt. an acre of fertilizer of which phosphate is the dominant constituent, while in districts of such low rainfall, as is normal in Canterbury, superphosphate at the rate of about 1 cwt. an acre mixed with an equal amount of carbonate of lime is favoured.

The sowing of soft turnips also is often carried out successfully during December, 12 oz. to 14 oz. an acre of seed in rows 7 in. apart being used frequently as also is a seeding of 8 oz. to 14 oz. an acre in rows 14 in. apart, while in the case of crops to be thinned about 9 oz. to 14 oz. of seed are sown in drills 26 in. apart, and when soft turnips are broadcasted about 2 lb. of seed an acre are used.

Rightly chou moellier maintains its popularity, which in some districts seems to be increasing, this possibly because of its reliability and its relatively low labour requirement. It is highly desirable to bear in mind that success with chou moellier calls for high fertility such as is required for success with cabbages. If suitable fertility is not present naturally it may be provided by the use of farm manure, such as old stack bottoms and animal excreta, together with artificial fertilizer

in which superphosphate may well be prominent. Sowings in December provide winter feeding. A suitable sowing is 1½ lb. to 2 lb. an acre broadcast or ½ lb. to ¾ lb. an acre in drills 2 ft. to 2½ ft. apart.

Much of the considerable area devoted to rape in New Zealand is sown in Canterbury or in districts with climatic conditions which approximate those of Canterbury. The fullest success with rape calls for a well-prepared, firm, fertile, moist seed-bed. As a rule ten weeks to twelve weeks on light land and twelve weeks to fourteen weeks on heavy land elapse between the date of sowing and the date the crop reaches the best stage for use in the fattening of lambs—called the "ripening" stage. Sowing usually is carried out from late in October on light land to January on heavy land, on which sowing prior to early November is not usual because rape responds well to warmth at the outset. Rape usually is sown at the rate of 2 lb. to 3 lb. an acre, being drilled in rows 7 in. or 14 in. apart. On heavy land the 14 in. rows are usually preferred, as the wider rows minimize the wastage that sometimes occurs in dense crops. Good results may be expected from the use of 2 cwt. to 3 cwt. an acre of a mixture in equal parts of superphosphate and lime drilled in with the seed, while reverted superphosphate at the rate of 2 cwt. to 3 cwt. an acre is also a suitable fertilizer for rape. While the area of rape required to fatten a given number of lambs varies greatly mainly because of substantial variations in the yields of different crops and in the drafts of lambs to be fattened, the following generalizations are in accord with field experience: A good crop of rape fattens twenty-five to thirty lambs an acre, an average crop fifteen to twenty-five lambs, and a somewhat poor crop eight to fifteen lambs an acre.

In the sowing of swedes, turnip, rape, and chou moellier special care should be taken to avoid the serious injury to the seeds which results by bringing them in contact even for a short time with readily soluble manures such as superphosphate, sulphate of ammonia, and potash salts. One way of avoiding the injury caused by superphosphate is to mix one part, by weight, of suitable ground limestone (carbonate of lime) with one or two parts of superphosphate. The mixture should not be bagged as soon as it is made as it usually sets hard to some extent; it may be bagged after it has been made two or three days, when it may be pulverized easily in the heap. Unfortunately, some lines of ground limestone are not effective for the purpose just mentioned, and a farmer uncertain about the efficiency of any particular limestone for this purpose may obtain guidance from the local officer of the Fields Division

In some districts the use of borax for the control of brown heart in swedes is advisable, but in other districts it is considered unnecessary, and evidence points to the indiscriminate use of borax being at times wasteful.

There seems to be some confusion as to the purpose of using borax in growing swedes, it being thought in some instances that the use of borax would assist in the control of such diseases as dry-rot and club-root. Actually the use of borax is recommended solely for the control of the specific disorder brown-heart, and where brown-heart has not been in evidence the use of borax is not known to give any benefit. Borax, if not used in a suitable manner, is known readily to lower the germination of swede-seeds to a serious extent. Full particulars about the safe and profitable use of borax under varying conditions may be obtained from the Department of Agriculture.

Spraying for the control of late blight of potatoes (*Phytophthora infestans*) may be advisable. For this purpose Bordeaux mixture has proved effective provided a thorough covering is maintained. This may necessitate frequent spraying, but in dry seasons or in dry districts it has been found that spraying is not necessary. Generally spraying may

be expected to give good results only when it serves as a preventive instead of as a cure. While spraying may be of considerable value in checking the spread of blight which has gained a footing, its greatest service results from preventing the footing being obtained. If suitable procedure is not followed in either preparing or applying the spray the result is likely to be either damage to the crop or failure to control the blight. Detailed guidance about spraying may be obtained from local officers of the Fields Division.

Maize and millet to provide green feed usually may be sown with success in November or December. Good results have been obtained by sowing maize broadcast at the rate of 75 lb. an acre (12 lb. to 15 lb. an acre in rows 3 ft. apart are sown for cob maize) and covering the seed by a very shallow ploughing. Sowing Japanese millet at the rate of 15 lb. to 20 lb. of seed an acre has consistently given good results. Usually both of these crops profitably may receive 1 cwt. to 2 cwt. an acre of superphosphate, and unless the soil is distinctly fertile it usually is profitable to include also some nitrogenous matter in the manurial dressing.

In its advisory work the United States Department of Agriculture emphasizes that "good seed is cheap at any cost, poor seed is time and money lost," a pithy statement of facts which well might be given more attention by New Zealand farmers than it seems to receive. According to the Seed Analyst, the work of the New Zealand Seed-testing Station shows that the standard of the seed trade in New Zealand is, on the whole, a high one. While this is a matter for congratulation, against it is to be set the fact that very poor lines of seed are at times sold to farmers who do not take the precautions needed to ensure a supply of truly satisfactory seed; in fact, these poor lines of seed are at times so poor that it is quite impossible to get any but grossly disappointing and unprofitable results from their use. Assuming that the appropriate strain or variety of seeds is being purchased, the real value of the seeds depends basically upon (1) the extent to which they are true to name, (2) the percentage of the true-to-name seeds which are capable of germination, and (3) the vigour of their germination. The farmer must depend to some extent upon the integrity of the seed trade in respect to the seeds being true to name, but he has some important protection in that official information is obtainable as to the impurities and inert matter in seeds, and impurities may include most undesirable weeds. The farmer is able to obtain from official sources all necessary accurate information about the germination of seeds. A point to which it seems necessary yet to direct attention, although it often has been emphasized in the past, is that neither the appearance nor the bushel-weight of seeds is a reliable index of their real value and, indeed, in purchasing seed one may go far astray by using either appearance or bushel-weight, or both of these, as a measure of value.

### Intertillage and Thinning.

Insufficient tillage is one of the most common causes of crops being limited in yield. The value of the cultivation which gives a good seed-bed is generally known even though at times, judging from farm practice, this knowledge seems to be overlooked. But the value of suitable cultivation after the sowing of the seed, when such cultivation is practicable, is not so generally realized; and this type of cultivation is of special importance at this season. Apart altogether from weed-control, which is of basic importance, a growing crop in badly cultivated ground is not likely to obtain the fullest possible benefit from money spent on good seeds and the liberal use of suitable fertilizers. Further, if a dry spell of weather occurs such a crop is likely to suffer in

yield because of the inadequate supply of moisture in the soil—suitable surface cultivation assists in conserving soil-moisture. Hence, intertillage of growing crops sown in rows wide enough apart to allow of it is in general highly desirable even though weeds are not a menace to the crop. This is particularly true of the drier districts.

Often in December thinning, as well as intertillage, of crops sown in October or November is advisable. The task of thinning usually may be lessened by prior hoeing along the rows. Thinning is most valuable if done as soon as the seedlings are large enough to allow of easy handling. The weeding which is carried out during such early thinning brings about the destruction of the weed-seedlings at the stage when they are most easily destroyed. In thinning mangels the soil should be drawn away from the seedlings rather than hoed up to them.

—*R. P. Connell, Land Utilization Officer.*

# THE ORCHARD.

## Pest and Disease-control.

REFERENCE to the spray programme issued in the September number of the *Journal* will act as a guide to growers with their spraying operations during the next month or so. In the spray schedule given on page 179 of the September *Journal*, under (3) "Petal-fall period," a transcription error has occurred—the lime-sulphur dilution should read 1–150, not 1–500 as printed.

Fruit-trees are now in full leaf, and therefore it will be more difficult to obtain a complete coverage with the spray. A little extra time spent on each tree to ensure that every branch, twig, and leaf has been coated with spray will be time well spent. Good pressure is very necessary, especially if the trees are at all dense. The system of pruning with the reduced number of leaders that is now being practised in many orchards materially assists spraying operations, as it enables all parts of the tree to be reached with comparative ease. From now on warm, dry weather conditions may be expected, and some growers are apt to take undue advantage of such conditions by lengthening the period between sprays, insecticidal or fungicidal, beyond the time for which they are effective. It must be remembered that to get the best results from spraying a protective covering should be on fruit and foliage all the time; consequently to extend the period between sprays over the recommended fourteen to eighteen days is running an undue risk. Insect pests are on the increase at this period of the year, and precautions taken now will prevent them from establishing themselves to the detriment of fruit and foliage later in the season. Many growers are inclined to leave the first application of lead arsenate for the control of codling-moth until the fruit is well advanced. It should be remembered that the "calyx" spray is of importance in the control of this pest, and neglect in this respect cannot be remedied. This early spray of lead arsenate will also control bronze beetle. As previously recommended, lime-sulphur solution may now be reduced in strength to 0·083 per cent. (1–180), especially where colloidal sulphur at a dilution of 2 lb. per 100 gallons of spray is used in combination. Where the lime-sulphur and lead arsenate are used in combination it is advisable to add to the mixture 2 lb. of hydrated lime to prevent russet and scorch. Regular sprayings with lime-sulphur at this time of the year should keep red-mite in check until January, when it may be necessary to apply summer oil at strength 1–100 for its control.

### Thinning.

Reports from all parts of the Dominion indicate that, with the majority of varieties of apples, the setting of fruit has been good; and, although a customary natural dropping may be looked forward to, it appears as though the crops are going to be particularly heavy. Growers are therefore advised to spend more time on thinning fruit than has been the usual custom. There is no doubt that this practice is not given the attention it should receive, with the result that many growers harvest a large crop of small fruit. It should be remembered that whilst it costs more to prepare a crop of small fruit for market, the price obtained for such fruit is almost always below the average. Very seldom does a grower over-thin his fruit crop—usually it is the reverse. It is not the quantity of fruit that is taken off the tree when thinning that counts, but the balance left on the tree after adequate thinning has taken place. The ground round the tree may be carpeted with small fruit, and still the tree have too much left on to give the best results. Not only will the proper thinning of fruit produce improved quality on the remainder, but at future sprayings more efficient coverage of the fruit to protect it from codling-moth and leaf-roller caterpillar will be obtained. The resultant crop will also be more uniform in size, whilst the grade will be raised considerably. The elimination of diseased, malformed, and clustering fruit will reduce the percentage of waste to be handled at harvesting time, and also help to promote more growth and bud development on the tree for the production of fruit.

At least two thinnings should be given to the majority of varieties, and in some cases it is of advantage to give three, usually commencing soon after the natural drop for each variety has taken place. During the first operation all clusters should be reduced to two or three fruits at the most, always taking out the centre fruit. Care should be taken not to injure the remaining fruits or spur. The operation can readily be done by pressure of the fruit to be taken off between the thumb and finger, with little or no damage to the spur. If this method is not favoured, thinning-shears can be used, but care must be taken not to pierce the remaining fruits with the points of the shears. At the second thinning all diseased or malformed fruits should be eliminated, and any further spacing necessary should be attended to. The object should be to see that every individual fruit has sufficient room to develop and mature naturally. If this is done fruit of good colour, shape, and size will be the result.

### Grafts.

Grafting for the season will have passed long before these notes appear, and the scions should now be starting well into growth. It is well to examine these grafts periodically and see that no strangulation is taking place by the bindings (where used). Where such is the case, the binding should be cut on the opposite side of the stock from the graft to allow for the free growth of the scion, which is usually heavy at this time of the year. All growths coming from the stock should be rubbed off, except in cases where the renovation of trees by the "porcupine" system of grafting has been done. It is sometimes necessary to leave a growth here and there, where a graft has not taken, to provide good wood for budding-purposes later in the season; otherwise all shoots should be suppressed.

### General.

Growers are advised to keep a sharp look-out for signs of fireblight. Blossom-infection not detected will spread to the twigs and laterals, when the foliage on affected portions will droop, turn brown, and hang on the tree. All such infections should be cut out and destroyed as soon as possible.

Cultivation should be continued throughout the month by frequent stirrings of the soil by harrow or cultivator, especially after rain. This will not only reduce the soil to that fine tilth so necessary, but will help to conserve moisture for the drier periods later in the season.

As harvesting time is approaching, casemaking should be undertaken at every opportunity. Packing-sheds and grading-machines, &c., should also receive attention. Usually during the off-season the packing-shed is the housing-place for almost every spare part on the farm, whilst in some cases rotting fruit is allowed to remain until the following season. Reports on the fungal rotting of fruit on the overseas markets point to unhygienic conditions prevailing in and around the packing-shed; therefore it is imperative that every grower should take the necessary precautions to see that the packing-shed and its surroundings are kept clean and in an hygienic condition to avoid further losses in the future. This can only be done by a thorough cleaning of the packing-shed, grading-machine, lidding-press, benches, &c., getting rid of any old disease-ridden fruit-cases, and by thoroughly spraying the whole with a solution of bluestone (1 lb. per 400 gallons water), (metals should be protected from this solution), or with formalin solution (1 part by volume of commercial formalin to 50 parts water).

—*George Stratford, Orchard Instructor, Motueka.*

**Citrus Culture.**

Most citrus trees will be in bloom when these notes appear, this, being the commencement of the next main crop, is also the commencement of the period wherein the trees require expert cultural attention. Neglect to cultivate at any period during the development of the fruit may result in considerable loss.

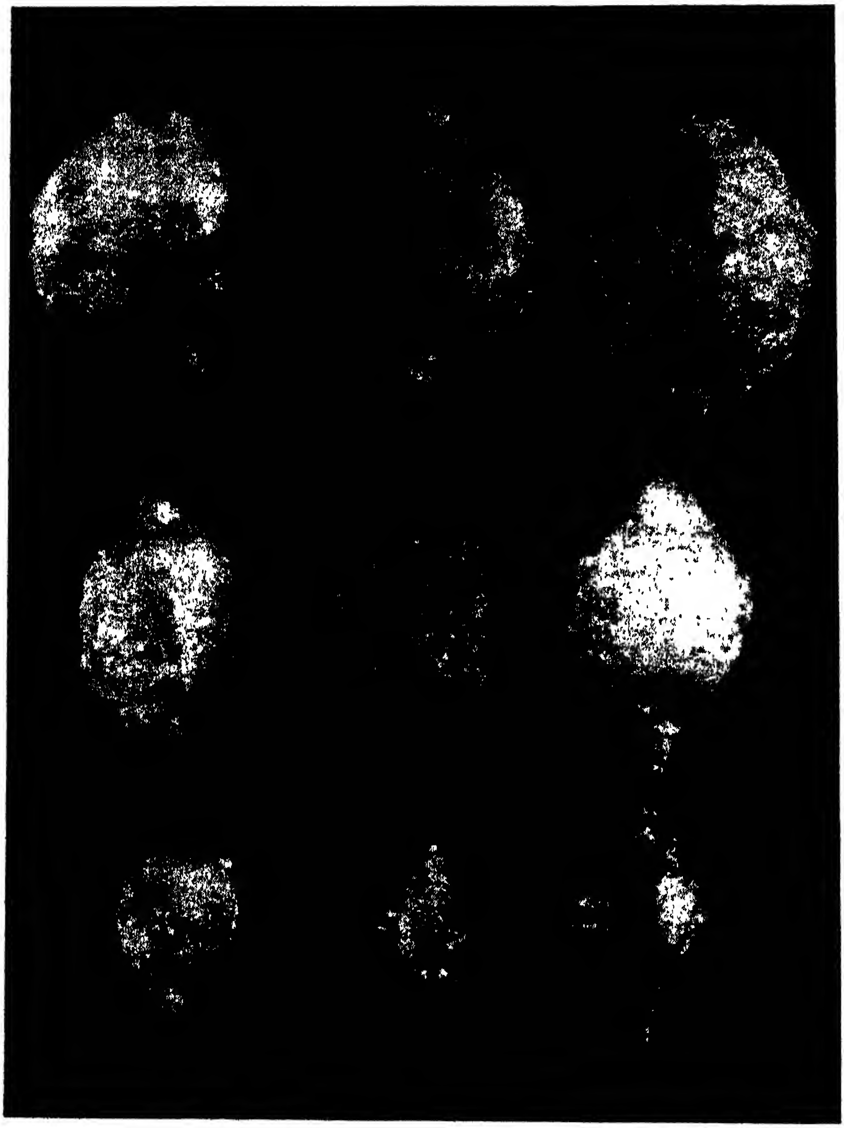
*Disease-control.*—As mentioned in these notes for the previous month, this is the most important period of the year for the control of verrucosis, and where there is danger of infection the trees should receive their first preventive spray when the earliest fruits of the main crop are setting. Bordeaux mixture at a strength of 3–4–50 is recommended for this purpose.

Bark-blotch is a disease that kills the bark and is usually found attacking mature trees either on the trunk or in the main forks of the tree. The presence of the disease is indicated by a slight discoloration of the affected area, and not infrequently is associated with an exudation of gum. The disease is particularly active at this period of the year, consequently all trees should now be examined carefully for signs of infection. Control-measures consist of cutting out all of the dead bark—cutting well back into the healthy bark—and swabbing the wound with bordeaux paste. When dry the area should be painted with a wound-dressing of the bitumen-emulsion type. Before commencing to operate on a diseased tree a ground-sheet should be spread around the tree to catch all of the diseased tissue removed. This infected material should be burned and not left in the orchard to become a source of further infection.

*Insect Pests.*—The examination of trees for the presence of wood-borers can be made at the same time as the trees are inspected for bark-blotch. The treatment for this pest appeared in these notes for December last.

Scale insects are probably the most persistent of the insect pests attacking citrus. The two species most prevalent are the black scale (*Saissetia oleae*) and the red scale (*Chrysomphalus aurantii*). Hot, dry weather heralds the period of greatest activity of citrus-scale insects. Young scales of the former species are commonly found in large numbers as early in the season as November. The presence of these scales is usually

indicated by a rapid spread of the sooty-mould fungus on the foliage. Spraying with a summer oil 1–60 should be resorted to as soon as the insects become troublesome. The addition of 1 per cent. summer oil to the Bordeaux spray to be applied for verrucosis-control will kill many of the young scales. Red scale is more difficult to control, and in dry



LEMON FRUITS AFFECTED WITH CITRUS-VERRUCOSIS.

seasons at least four applications of summer oil at a dilution of 1–33 may be necessary to effect a satisfactory control. The first application should be made during December–January if young scales are hatching freely, the second in late February, the third towards the end of March, and the fourth about mid-April.

Citrus thrips are usually prevalent during the main blossoming period, after which they have been observed to almost completely disappear from the trees. Late in January or in February they reappear on the fruit and foliage and rapidly multiply as the season advances. Spraying experiments conducted over two seasons by this Department with various specifics indicated that sprays applied during or near the blossoming period had little or no effect on either the amount of thrip injury to the fruit or on the setting of the crop. However, good control of thrips was secured later in the season. The control-measures recommended will be supplied in my subsequent notes.

*Mulching.*—The need for supplying organic matter to the soil around citrus trees is realized more now than at any previous period. No matter what quantities of fertilizers are applied, the maximum results cannot be expected without an ample supply of humus in the soil. In orchards of mature trees where most of the land is covered by the spread of the branches it is, in some cases, not possible to grow a satisfactory cover crop. Where such conditions obtain an area adjacent to the orchard should be set aside for the purpose of growing organic matter such as lucerne or clover. The crop can be cut several times during the season and applied as a mulch under the spread of the trees. This material very soon decays and mingles with the soil, and at the same time will greatly conserve the soil moisture during the summer and autumn months. Several citrus growers have adopted this practice in recent years with encouraging results.

—*P. Everett, Orchard Instructor, Gisborne.*

# POULTRY-KEEPING.

## Feeding.

The primary purpose of feeding is to sustain life, build up waste in tissue, and maintain natural conditions, and, secondly, that certain materials may be transformed into more suitable forms of food for human consumption in the shape of eggs and poultry-meat.

The most commonly used and satisfactory foods for poultry in this country are obtained from grains, such as wheat, maize, barley, and oats; mashes made up of pollard, bran, wheat-meal, oat-pollard, barley-meal, or maize-meal; animal food in the form of meats, meat-meal, milk, or fish-meal; mineral matter in the form of oyster-shell grit, also metal grit and succulent green food. The last, but by no means the least, essential is a good, clean, fresh, and constant supply of water.

All foods are composed of certain substances, which have been grouped by chemists into the six following classes: Water, carbohydrates, protein, fat, ash, and vitamins.

When the food is digested and assimilated each substance performs a particular function in nutrition, promoting growth or egg-production. It will thus be seen that the success to be obtained from the feeding of any particular food or ration will depend, to a large extent, upon the correct balance of the various substances contained therein.

While the feeding of a well-balanced ration will always give the best results where a flock of birds is concerned, there are at times factors beyond one's control, such as climate, soil, and individual temperament when foodstuffs do not always have the same value or the same physical effect upon all systems. The poultry-farmer is advised, however, to give some time to a study of this important branch of his work, and he would be wise to have on hand a table giving the analyses of the various available foods, as such will often be useful and assist in a

more intelligent use of certain foodstuffs. Science has done, and is still doing, great work for the poultry industry, and a perusal of reports from world research workers makes very valuable and interesting reading and is time well spent.

While it is recommended that the poultry-farmer should know something of the composition of the most popular foodstuffs, it is not suggested that the beginner should first spend time and perhaps money in trying to make up or experiment with new mixtures. The novice should really first learn just *how* to feed and manage his birds, and when it comes to exactly what to feed, his best plan would be to follow very closely the methods adopted by some successful poultry-keeper, for the successful man does, as the result of practical experience, feed his birds in a scientific way, although perhaps theoretically he may not know much about how to tell whether a certain ration is scientifically balanced or not.

### Process of Digestion.

The process of digestion in poultry differs from that of animals which chew their food. Briefly, science describes the process as follows: Fowls swallow their food and it is passed into the crop without mastication; here it absorbs moisture, which softens it and aids in its passage to the gizzard. The crop is really a store-house for food, and as it is required it is passed into the esophagus or stomach. Here it is mixed with secretion similar to saliva, which acts upon the carbohydrates, converting them into sugars. The food is then passed into the lower stomach, when another juice—the gastric—is poured upon it, thus reacting upon the proteins. After leaving the stomach the food is passed to the gizzard, where, by the aid of powerful muscles and sharp grit, it is ground into pulp. From the gizzard the food is passed into the small intestines, where two more secretions—the bile and the pancreatic juice—are mixed with it. These juices emulsify the fats; they also act upon the carbohydrates and proteins, and continue the work started by the saliva and gastric juice.

The digestible nutrients are taken from the food and converted into blood. This process goes on as follows: The inner walls of the intestines are covered with very small projections, which absorb the digested material from the contents of the intestines. There are two kinds of small tubes within these projections. One kind connects with the waste-gathering system and conducts certain material to a large tube along the backbone, the contents of which are eventually taken up by the blood.

The other kind of tubes belong to the blood-circulatory system; they conduct other digested material to the liver, where it is purified before it is used to build up the body. The indigestible part of the food passes into the rectum, and out of the body.

### Breeding and Environment.

In order that this transformation of food may take place in a profitable way it is, of course, essential that the birds possess that inherited constitution in order that all organs of the body can carry out their various functions in a constant and efficient manner. When it comes to great egg-production it must be remembered that birds not only need great stamina so that the system will stand up to the drain of heavy production, but they must be endowed with that inherited faculty which enables them to produce a large number of eggs, for the very best of feeding will not transform a naturally poor layer into a very prolific producer.

These are, of course, matters of selection and breeding, but they must be given careful and constant attention before the most profitable returns can be expected from any particular system of feeding.

### Environment.

As environment includes all the external circumstances of an organism and the great function of environment is to sustain, not to modify, it should also be remembered that proper care and management are vital essentials to success.

It is not unusual to find a successful man feeding a certain ration, while his neighbour, who feeds the same class of ration to a similar strain of birds, fails to make a success of the business. This is why many experienced poultry-keepers will argue that good environment is of equal importance as good breeding. Even the very best of birds must be kept in good health, and judgment must be exercised and care taken to see that the quality, quantity, and regularity of the food-supply is correct, and also that sufficient exercise and good housing-conditions are available. These points have been mentioned because the novice, if not getting satisfactory results, often varies his method of feeding, when the fault lies in the direction of some condition existing in the environment.

### What to feed.

There are, of course, many different mixtures and systems which have been used successfully. The following is one that is commonly used: A mash made up of two measures of pollard, one of bran, and from 5 per cent. to 10 per cent. of meat-meal (a little extra pollard is added if quality is poor), the lot mixed to a crumbly state with water, skim-milk, or soup. Up to 10 per cent. of meat-meal is fed from about April to August, when it is gradually reduced until by September not more than 5 per cent. is given. The amount of meat-meal may again be gradually increased about November

Where milk or soup is used to mix the mash, less meat-meal should be used.

This mixture should be fed in troughs and as much given as the birds will clean up in half an hour. It is usual to feed the mash first thing in the morning and grain at night, but it really does not matter whether the mash is fed night or morning. However, it is better not to be always altering the times of feeding. A good feed of succulent green food is given each day; some feed this about noon, while others prefer to give the green food after the last feed in the evening.

Wheat is the most popular grain, and where available a grain mixture that has given good results is made up of three measures of wheat and one each of barley and broken maize. The grain should be fed in deep litter in order to encourage exercise, and as much given as the birds will clean up in about half an hour.

A supply of oyster-shell and metal grit should be always within reach of the birds. Great care should be taken to see that the water-supply is constant, fresh, and clean.

Further feeding notes will appear next month.

*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

## THE APIARY.

### Artificial Increase.

ARTIFICIAL increase may be accomplished in several ways, but perhaps the most satisfactory is by means of nuclei and division. A nucleus is best formed of two frames of emerging brood and young bees, one frame of honey, and one containing pollen. This must be completed by a virgin queen or a ripe cell. The nuclei may be utilized throughout the season for the mating of queens for renewal, and at the end of

the summer, if two or more are united or if each one is reinforced by the addition of bees and brood from strong colonies, they may be wintered in safety and will form good stocks for the next season. No surplus can be expected from them the year of their installation.

In dividing it is best to wait till the colony is preparing to swarm and ripe queen-cells appear in the hive. The hive can then simply be split in two by putting half the bees and brood on another stand, taking care to leave queen-cells in each division, and for preference putting as much emerging brood in the half which is to be placed in a new position. This latter precaution is necessary in order to make up the wastage from the field-bees that will return to the old stand. Each hive can then be completed by filling the vacancies by drawn-out combs. The queen-cells in the queenless half will be nursed by the young bees, while those in the half containing the queen will be torn down by the bees when they find the hive depleted. If the apiarist wants to be quite sure of this being done he may search for the queen and remove her in the hive on the new stand. The division method is advocated on account of its simplicity and the fact that there is no necessity for finding the queen before the operation. It is a most effectual preventive of swarming and saves a great deal of trouble where increase is desired.

### Supering.

In most districts November is early enough for the employment of supers, though much depends on weather-conditions. If the weather is warm, the hives full of bees, and nectar coming in freely, the supers may now be added at any time However, it is of no use discouraging the bees by giving additional space before the weather is warm enough to justify it. If increase is required it is as well to confine the bees to one story till the hive is overflowing with bees. This is almost certain to produce a desire to swarm, and the hive can either be allowed to swarm naturally or be divided artificially. When the first super is put on it is best, if possible, to fill it entirely or partially with drawn-out combs. If only foundation is available, one or two combs—not containing brood—may be removed from the bottom story to the top, and sheets of foundation put in their place. On no account disturb the brood until settled weather eventuates. If foundation is used in the super, queen-excluders should not be used, as the bees will rarely travel through the excluders to work the foundation and will usually swarm. Do not bring excluders into use until the bees are quite accustomed to working in the supers.

### Care of Bee-yard.

Before the supers are put on it is advisable to see that the hives are raised well above the ground, so as to provide ventilation underneath and also to prevent the hives becoming a shelter for insects. The bottom-boards should be raised at least the height of a brick from the ground, and they may even be a little higher, though in the latter case the alighting-board should be long and sloping to enable the heavy-laden workers to reach the hive easily if, as so often happens, they miss the entrance when descending at the end of their homeward flight. All grass and weeds should be cleared away from the hives, particularly at the entrances. To save the continual labour of this operation during the spring and summer it is a good plan to skim the weeds from the ground and to spread agricultural salt in the proportion of about 6 lb. per hive to prevent their reappearance for the season. Although this is only a temporary remedy it should save mowing the grass for at least one season. Whatever the labour, the entrances must be kept free ; the

bees' lives are all too short and arduous, and the energy wasted in forcing their way through the tangle of weeds sometimes seen in apiaries must amount to a good deal in the course of a season.

—*E. A. Earp, Senior Apiarist.*

# HORTICULTURE.

## Vegetable Crops.

About the beginning of the month of December, when a variety of vegetables is available, it is advisable to stop cutting asparagus and allow the plants to mature their growth. In doing this they should be assisted by applying a generous dressing of manures and fertilizers. The crop has probably had a few applications of nitrates during the cutting period and now requires a substantial and more varied application. In deciding on its composition it is well to remember that a generous supply of humus in the soil should be maintained and the crop is partial to a good supply of potash, but phosphates must not be altogether omitted. The dressing is applied between the rows and cultivated in. For somewhat similar reasons the rhubarb crop should receive the same attention.

As the early crops of peas, potatoes, salads, &c., are cleared the ground is prepared for such winter crops as celery, leeks, savoys, red cabbage, Brussels sprouts, cauliflower, broccoli, &c. All of these crops are partial to lime, and, in most instances, it is a suitable occasion to apply a generous dressing. If ground raw lime is used (carbonate of lime) it is important that it should be finely ground. Burnt lime in powdered form (hydrated lime) has had the carbon driven off in the burning process; it is caustic, essentially stronger, and quicker in its action. It should be used only on the heavier land. As liming is often neglected, it should be remembered that not only is it required by certain crops, but on heavy land especially it is necessary in order to maintain the soil in a mechanically friable condition while on land inclined to be acid, as is so often the case, it is required to enable such fertilizers as superphosphate and sulphate of ammonia to function effectively. As it leaches out there is no need for anxiety regarding the behaviour of crops requiring an acid soil, such as potatoes, tomatoes, strawberries, &c., that may be planted later; in fact, such crops do rather better on land which is only slightly acid. For this class of cropping lime is sometimes applied annually in moderate quantities such as half a ton to the acre, equal to about 3 oz. to 4 oz. to the square yard, or at longer intervals in quantities up to 2 tons per acre.

A moist soil, rich in humus, and well drained is required to produce a good celery crop. On land of this description such varieties as Golden Self-blanching may be planted 9 in. apart and 12 in. between rows. A wider space should be allowed after every sixth row to give access for spraying, weeding, &c. In preparation for planting a good dressing of manure, such as fowl-manure and, if the land is light, an equal part of cow-manure, is ploughed under. While cleaning the land an application of superphosphate and sulphate of potash is worked in. Where a liberal preparation has been made for the previous crop this treatment may be modified accordingly. Where a larger variety, such as Solid White, is to be grown a good deep drill may be struck at intervals of 3 ft., the fertilizers worked in, and the plants set out in the drills at intervals of 8 in. or 9 in. In dry localities and soils it is necessary to plant out in prepared trenches to economize and facilitate the application of irrigation water. This crop must be kept growing steadily, and

to do this it must not be allowed to lack moisture ; irrigation by flooding or sprinklers is frequently necessary to supply its requirements in this respect. To control the attack of leaf-spot disease (*Septoria Apii*) spraying with Bordeaux 3–4–50 is usually necessary at intervals of about three weeks from the seedling stage onwards. Washing-soda may be used in the place of lime (it is then known as a Burgundy mixture), and it is indeed preferable in the later stages of growth, as there is less residue left on the stalks. In any case, care must be taken to see that a thoroughly clean product is placed on the market.

During the month of December a late crop of peas may be sown, also shorthorn carrots, globe beet, lettuce, and, in warm districts, dwarf beans.

An important operation at this season is to mow hedge bottoms and headlands where weeds and rough grass are growing in the vicinity of these crops. If this is done before seeds are formed it will do much to control the spread of weeds, and the material will be useful for mulching, or, if stacked green in the compost heap, humus for application to the land later.

### Small and Sundry Fruits.

Planting distances for the tomato crop under glass vary widely in practice There is often a tendency to crowd the plants with a view to getting the greatest possible weight of fruit from the limited area. At the Cheshunt Research Station last season this matter was the subject of an interesting test, which is to be repeated. Plots were planted 18 in and 27 in. between rows alternately, and 14 in between plants. Others with similar spaced rows and 18 in between plants. Others, again, 27 in. between all rows and 14 in between plants And yet others 27 in. between rows and 18 in. between plants. The results indicate that the yield per acre was practically the same with each of the different methods of planting. Also there was little to choose between the different methods as regards the quality of the fruit, which however, tended to be slightly larger where the spacing was wide. Although it was not stated, there would hardly be any doubt that the cost of production would be lower where the spacing was wide and the management would be greatly facilitated. A very fine crop was seen here recently in a heated house spaced 24 in. and 30 in alternately between rows and about 14 in. between plants Experience appears to indicate rather strongly that most growers would be wise to increase planting distances, especially where early crops are grown in heated houses, or without heat in the warmer and humid localities. The unseasonable frosts experienced in mid-October in many districts were a considerable check to the early outdoor crop, and the crop under glass should realize good prices for a longer season as a consequence.

Where fine weather and high temperatures are experienced for a long period during the summer it is often an advantage to apply a light shade on crops of tomatoes under glass. This may be done by mixing whiting and linseed oil and applying it to the roof of the house outside in the form of a light spray. With good ventilation and a mulch the plants will then often keep their condition better. In warm districts where a late crop of tomatoes is planted outside about the middle of December the plants will stand up to winter conditions better if nitrogenous manures are used sparingly and the ground is firm when planting out.

The gooseberry crop is in many instances harvested in a green condition, but it should be more generally realized this fruit makes an excellent conserve if gathered as soon as it commences to turn colour and before the skins become tough.

Egg-plants and peppers should now be planted out in the warmer districts. There are signs of an increasing appreciation for these fruits.

### The Homestead Garden.

Half-hardy flowering annuals are now available for planting out and are useful for brightening up any desired position in the garden and affording variety and a new interest. In wind-swept, bone-dry, or shaded situations there are plants of this class which will thrive and bloom abundantly in any position if carefully selected. Planting is best done when a period of dull or showery weather may be expected, and if this operation is preceded by working into the soil a little bone-dust and superphosphate, and followed up (if a dry period should be experienced) by occasional irrigation until the plants are established, little further attention will be required.

Thinning, stopping, staking, and tying young growth and buds of plants in the herbaceous border occupies considerable time now if a good display is to be obtained. On that account it is wise to keep this area well within the limits of the labour available.

Where narcissus and other spring-flowering bulbs are to be lifted it is usually best done now as soon as the foliage really commences to die off. The bulbs should not be unnecessarily exposed to the sun, but spread thinly in a well-ventilated shed or other position free from draughts and strong light. When dry they are cleaned, graded for size, and stored in a dry, cool shed until wanted for planting. Some kinds, chiefly from Africa and the Continent of Asia Minor, are rather exceptions to this rule in so much that they can hardly be sun-roasted too much, as in their native state they are accustomed to hot, dry summers. *Iris tingitana*, a native of Tangiers, is a handsome winter-flowering, bulbous iris which in some places refuses to bloom without a summer treatment of this kind. Where it is not desired to lift bulbs of this class the necessary conditions for flowering them satisfactorily may sometimes be provided by covering the plants with a glass frame as soon as they die down, and so providing the dry, hot conditions required during the resting period.

When the bedding plants in the frames are cleared consideration may be given to sowing seeds of perennial herbaceous plants such as anemone, pansy, viola, primrose, polyanthus, &c.; also biennials, such as stocks and wallflowers; and during the months of February and March hardy annuals, including sweet peas, for flowering during winter and spring.

During dry periods in summer late-planted shrubs and those, such as rhododendrons, which like moisture, should be watered well and given a light mulch of half-decayed stable manure or lawn clippings, &c. Young climbing plants set at the base of a warm wall will be specially grateful for such attentions.

As garden operations have to be planned for at least twelve months ahead special consideration should be given now to the requirements of the planting season, whether it be for timber or shelter, fruit or flowers —the kind, variety and number of each required should be decided and the position they are to occupy. Also any removals of young trees or shrubs into a different position in the garden that may be required should now be decided on. Notes of this kind made during the summer and the local nurseries searched for suitable stock, will enable the preparation of the land to be undertaken in due season and planting done to best advantage.

—*Wm. C. Hyde, Horticulturist, Wellington.*

# WEATHER RECORDS: OCTOBER, 1937.

Dominion Meteorological Office.

## NOTES FOR OCTOBER.

IN the Dominion as a whole October was a very dry month with a good deal of wind, which came mainly from a southerly quarter. The atmosphere was generally dry and cool and frosts were unusually numerous, especially in the South Island. Though there is, in most districts, as yet no acute shortage of feed, the growth of pastures and vegetation generally has been poor. The rains from the 23rd onward relieved conditions considerably in the North Island, but the subsequent fine weather with drying winds has, to a considerable extent, nullified their effect. Grass is tending to flower early, and while still short. Stock are, on the whole, in very good condition, especially lambs. Conditions are very favourable also for shearing. In portions of Marlborough, however, there is serious shortage of feed, and both stock and crops are doing poorly. General steady, soaking, and mild rains are needed soon or the effects of the dry weather are likely to become serious.

*Rainfall.*—Except for some good rains on the west coast of the South Island in the early part, the first three weeks of the month were extremely dry, many areas in the North Island having no rain at all. Between the 23rd and the 26th there were general rains, with heavy falls over most of the North Island. In the South Island few places recorded half the average for October, and large parts of Canterbury and Marlborough had deficits of over 80 per cent.

*Temperatures.*—Though there were no severe cold snaps, the average temperatures were almost everywhere considerably below normal. The frosts, though unusually frequent, were not of great depth or severity, and though tomatoes, potatoes, and other garden crops were damaged, fruit-trees suffered comparatively little.

*Sunshine.*—The month was remarkable for the amount of sunshine. Lake Taupo reports 281·4, Nelson 266·9, and Blenheim 261·5 hours.

*Storms and Pressure Systems.*—During the first nine days conditions were fairly typical of spring. Two westerly depressions crossed the South Island, causing some rather boisterous north-westerly winds as they approached and south-westerlies as they passed away. There were some heavy rains on the west coast of the South Island, but little elsewhere.

From this period onward high pressure was the rule, and the anti-cyclones were centred unusually far south. Southerly or south-easterly winds predominated and the situation was of a type which, though not very uncommon in summer, was the reverse of what is expected in spring.

Between the 13th and the 18th a moderate cyclonic depression passed across the north Tasman Sea and by Norfolk and the Kermadec Islands. On the 16th it caused easterly gales in the far North and some rain fell in the northern and eastern districts of the North Island. The centre was too far north to affect New Zealand greatly. It did cause, however, an increased flow of air from the south and south-east, and it was during this period that the worst of the frosts were experienced.

From the 23rd to the 27th a shallow cyclone developed in the northern part of a depression approaching from the Tasman Sea and moved slowly across the North Island. This was responsible for the general rains already referred to and snow on the ranges, expecially in the South Island. South-easterly gales were experienced in the Cook Strait area. On the 24th there were some severe thunderstorms in the Auckland Province.

From the 28th onwards the weather was again dominated by an anti-cyclone. On the 31st south-westerly winds on the southern side of it began to cause rain on the west coast of the South Island.

## RAINFALLS FOR OCTOBER, 1937, AT REPRESENTATIVE STATIONS.

| Station. | Total Fall. | Number of Wet Days. | Maximum Fall. | Average October Fall. | Total Rainfall to Date. | Average Rainfall to Date. |
|---|---|---|---|---|---|---|
| *North Island.* | | | | | | |
| | Inches. | | Inches. | Inches. | Inches. | Inches. |
| Kaitaia .. .. | 0·79 | 7 | 0·33 | 5·27 | 50·72 | 48·93 |
| Russell .. .. | 1·52 | 7 | 0·88 | 3·83 | 86·47 | 51·67 |
| Whangarei .. .. | 1·96 | 12 | 0·75 | 4·76 | 74·33 | 54·71 |
| Auckland .. .. | 2·07 | 6 | 1·02 | 4·06 | 38·11 | 42·58 |
| Hamilton .. .. | 1·12 | 7 | 0·58 | 4·60 | 32·97 | 42·03 |
| Rotorua .. .. | 4·21 | 6 | 2·68 | 5·19 | 40·71 | 47·10 |
| Kawhia .. .. | .. | .. | .. | 5·15 | .. | 45·90 |
| New Plymouth .. | 3·14 | .. | .. | 5·46 | 48·06 | 50·79 |
| Riversdale, Inglewood .. | 4·37 | 9 | 1·72 | 10·41 | 74·68 | 87·57 |
| Whangamomona .. | .. | .. | .. | 8·43 | .. | 64·53 |
| Hawera .. .. | 2·27 | 8 | 1·07 | 4·65 | 33·30 | 38·18 |
| Tairua .. .. | 2·78 | 3 | 1·69 | 5·81 | 46·65 | 56·44 |
| Tauranga .. .. | 4·90 | 4 | 3·58 | 5·11 | 47·19 | 45·52 |
| Maraehako Station, Opotiki | 1·86 | 7 | 0·74 | 5·35 | 51·82 | 47·29 |
| Gisborne .. .. | 3·36 | 10 | 1·50 | 2·67 | 35·16 | 39·95 |
| Taupo .. .. | 1·97 | 8 | 0·99 | 4·31 | 27·20 | 37·43 |
| Napier .. .. | 2·71 | 10 | 0·93 | 1·89 | 22·18 | 26·12 |
| Hastings .. .. | 2·09 | 10 | 0·83 | 2·11 | 18·07 | 28·16 |
| Taihape .. .. | 1·87 | 13 | 0·40 | 3·50 | 25·75 | 30·06 |
| Masterton .. .. | 1·79 | 11 | 0·40 | 3·24 | 27·99 | 32·78 |
| Patea .. .. | 2·06 | 8 | 1·07 | 4·25 | 34·50 | 37·28 |
| Wanganui .. .. | 1·45 | 3 | 0·67 | 3·46 | 25·59 | 30·18 |
| Foxton .. .. | 1·05 | 6 | 0·57 | 2·94 | 18·95 | 26·67 |
| Wellington .. .. | 0·94 | 7 | 0·30 | 3·51 | 28·07 | 36·38 |
| *South Island.* | | | | | | |
| Westport .. .. | 4·02 | 7 | 1·45 | 8·70 | 64·25 | 79·50 |
| Greymouth .. .. | 4·27 | 9 | 1·70 | 10·74 | 77·31 | 83·80 |
| Hokitika .. .. | 5·10 | 10 | 1·96 | 11·81 | 83·45 | 94·12 |
| Ross .. .. | .. | .. | .. | 14·77 | .. | 109·58 |
| Arthurs Pass .. .. | .. | .. | .. | 20·33 | .. | 131·69 |
| Okuru, South Westland | 4·39 | 3 | 2·62 | 15·21 | 116·47 | 120·90 |
| Collingwood .. .. | 0·78 | 7 | 0·37 | 10·08 | 63·76 | 82·03 |
| Nelson .. .. | 0·48 | 4 | 0·26 | 3·50 | 25·50 | 31·94 |
| Spring Creek, Blenheim | 0·34 | 5 | 0·15 | 2·56 | 20·41 | 25·79 |
| Seddon .. .. | 0·43 | 4 | 0·36 | 2·23 | 20·27 | 20·99 |
| Hanmer Springs .. | 1·89 | 9 | 0·35 | 3·92 | 28·61 | 37·83 |
| Highfield, Waiau .. | 1·32 | 9 | 0·31 | 2·60 | 19·07 | 28·12 |
| Gore Bay .. .. | 0·75 | 8 | 0·23 | 2·33 | 26·01 | 26·58 |
| Christchurch .. .. | 0·28 | 6 | 0·18 | 1·97 | 18·58 | 20·89 |
| Timaru .. .. | 0·30 | 6 | 0·15 | 1·98 | 16·36 | 18·31 |
| Lambrook Station, Fairlie | 0·34 | 5 | 0·18 | 2·06 | 14·65 | 20·37 |
| Benmore Station, Clearburn | .. | .. | .. | 2·30 | .. | 20·25 |
| Oamaru .. .. | 0·34 | 5 | 0·16 | 1·76 | 13·22 | 17·84 |
| Queenstown .. .. | 0·41 | 5 | 0·19 | 3·31 | 21·38 | 25·28 |
| Clyde .. .. | 0·09 | 2 | 0·08 | 1·62 | 11·68 | 12·12 |
| Dunedin .. .. | 0·80 | 8 | 0·33 | 3·09 | 33·05 | 29·97 |
| Wendon .. .. | 1·11 | 6 | 0·36 | 2·73 | 33·64 | 24·42 |
| Balclutha .. .. | 0·87 | 5 | 0·44 | 2·42 | 26·66 | 20·58 |
| Invercargill .. .. | 1·37 | 12 | 0·39 | 4·35 | 34·16 | 37·37 |
| Puysegur Point .. | 3·39 | 20 | 0·51 | 8·13 | 69·84 | 69·84 |
| Half-moon Bay .. | 2·48 | 13 | 0·41 | 5·17 | 48·07 | 48·10 |

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## SEED CERTIFICATION.

### SUMMARY OF OPERATIONS FOR SEASON 1936-37.

J. H. CLARIDGE, Certification Officer, Fields Division, Wellington.

THE Seed Certification Scheme of the Department of Agriculture has now completed its tenth year of operations, and the following report conveys to readers the scope of the scheme during the 1936–37 season. Extensive amendments were made to the scheme of white-clover certification before the commencement of the season under review, while the wheat-certification scheme was subject to minor amendments. The list of crops under certification was not extended in the past season.

With the commencement of the 1936–37 season higher standards of purity for the machine-dressed seed of most of the grasses and clovers were insisted upon. In general no difficulty has been experienced in dressing seeds to the required standard. The exception to this was in the case of cocksfoot-seed, where without amendment of the previous season's standard, considerable difficulty was experienced in dressing lines satisfactorily.

A 13-per-cent. increase in the applications received for certification brought the total number for the 1936–37 season above the 3,500 mark. This increase was due largely to the reorganization of the white-clover scheme, supported in smaller measure by increases in the number of wheat and potato crops under certification. A reduction in the perennial rye-grass areas was sufficient to offset to a large extent the above-mentioned increases however.

### GOVERNMENT STOCK SEEDS.

The Department combined its policy of producing supplies of certified "Government stock" seeds under contract in the past season, when 750 bushels of perennial rye-grass and 1,000 lb. of white clover raised from selected nucleus stock seed was readily disposed of through commercial channels. It was unfortunate in this respect that the perennial rye-grass-seed harvest was below average, as orders for this seed were more than double the quantity of seed available for distribution. One thousand pounds of cocksfoot seed of a strain selected by Lincoln College was also produced under the supervision of the certification organization and distributed by the College authorities for further seed-production.

### PERENNIAL RYE-GRASS.

Applications for the certification of perennial rye-grass-seed were only 72 per cent. of the number received in the previous season,

the reduction being greatest in the number of areas eligible to produce "permanent pasture" seed. Average yields per acre were also low. These factors combined resulted in a reduction of well over 50 per cent. in the total quantity of seed certified, which amounted to under 130,000 bushels for the season. In addition, the germination-capacity of much of this seed was below normal, resulting in a general shortage in the supply of the certified product.

Included in the 22,500 bushels of mother seed certified is the produce of over 300 acres sown out with certified Government stock seed in the autumn of 1936. This acreage produced over 5,000 bushels of machine-dressed seed, all of which proved to be of high quality in regard to type.

### Cocksfoot.

A slight reduction in the acreage of cocksfoot-seed entered for certification was recorded for the 1936–37 season, while a similar reduction was shown in the quantity of seed harvested. The Akaroa district has been responsible for these reductions, the acreage and quantity of seed harvested in mid-Canterbury (the only other district of importance) having increased quite appreciably.

Seasonal conditions, particularly on Banks Peninsula, were such as to mitigate the production of good-quality seed. Seed from the district mentioned was particularly light, and extreme difficulty was encountered in dressing the material to the quite reasonable standard required for certified seed, the main obstacle in this respect being the high percentage of kernel-less seeds present in many lines. This point is demonstrated by the fact that of 150,000 lb. of Akaroa-grown seed submitted for purity test after machine-dressing half this quantity failed to reach the necessary standard of purity.

The position in other districts was much easier, the percentage of rejections on purity being very little higher than in previous seasons.

### White Clover.

Commencing with the 1936–37 season an entirely new procedure was adopted in the certification of white-clover seed. It having been proven that use could be made of a chemical test on seedlings to determine type of clover, the system of plot testing, field inspection, and paddock-branding was replaced by a system necessitating temporary sealing of machine-dressed seed pending the results of the chemical test on an officially drawn sample of the seed.

The result of this alteration has been a remarkable increase in the quantity of seed receiving recognition as certified seed. Whereas in the 1935–36 season 56,000 lb. of seed was accepted under the certification scheme, from January to September of 1937, 460,000 lb. of seed was tested and approved as certified. This quantity is greater than the total quantity of seed certified during the previous eight years from the inception of a scheme of certification covering white-clover seed.

### Brown-top.

The certification of brown-top seed has now become relatively stabilized, fluctuations from year to year in the volume of the work undertaken being almost entirely attributable to seasonal variations. In the 1936–37 season 371,000 lb. of seed was finally sealed, this being a 75-per-cent. increase on the previous season's total. It is

estimated that at least three-fourths of the brown-top harvest receives the official endorsement of certification in each season.

### Red Clover.

Once again the demand for certified Montgomery red clover has far exceeded the supply—this despite the fact that the quantity of machine-dressed seed certified in the 1936–37 season exceeded the previous season's production of 23,500 lb. by 20 per cent. Actually the acreage entered in the season under review was more than double that for the 1935–36 season, but yields of seed during 1936–37 reacted against a corresponding increase in the total amount of seed certified. That Montgomery red clover under certain conditions produces a heavy seed yield is evidenced by the fact that one area in Hawke's Bay in the past season returned a yield of over 600 lb. per acre.

### Italian Rye-grass.

The acreage under Italian rye-grass certification has again shown a considerable increase, being 300 acres in excess of the 1935–36 season's figure of 378 acres.

The yield per acre of machine-dressed seed has fallen appreciably, but nevertheless over 12,000 bushels of seed were finally sealed and tagged as certified seed.

### Phalaris tuberosa.

The certification of *Phalaris tuberosa* has not advanced in the way that might have been expected. Ten areas comprising 85 acres were entered for certification in the season 1936–37, but no area produced a satisfactory yield of seed, and from the 33 acres harvested 1,500 lb. of machine-dressed seed was obtained.

### Seed Wheat.

The seed-wheat-certification scheme was subject to certain amendments prior to the commencement of the 1936–37 season. In the past many crops had been rejected at field inspection on the grounds that the sample of grain from these crops would not be satisfactory. It was decided to allow these crops to proceed to the grain-inspection stage, when an inspection of the grain sample itself would be the deciding factor in acceptance or rejection of the crop. This has caused a lower percentage of rejections in the field under the heading "general poor quality."

A second amendment was in the nature of a decision that only that wheat finally sealed and tagged after machine-dressing would be officially recognized as certified. This has resulted in a greater proportion of the accepted wheat being machine-dressed, giving to purchasers the benefits attached thereto, and at the same time eliminating an apparent weakness of the scheme that certified seed was not necessarily sealed and tagged.

General increases are again recorded in the scope of seed-wheat certification, acreages having increased by nearly 50 per cent. and the quantity of seed sealed and tagged having almost doubled.

It is of interest to note that the variety Cross 7 now holds pride of place in the quantities certified of the various varieties. Over 40 per cent.

of the 8,000 acres inspected was comprised of this variety, while, of the 47,500 bushels of seed machine-dressed, over 21,000 bushels was similarly comprised.

## Seed Potatoes.

An increase of over two hundred entries for seed-potato certification was recorded for the 1936–37 season, bringing the total number of crops inspected for the season to 891. Of these, 20 per cent. were rejected for various reasons, while 80 per cent. were passed for certification purposes.

An extension of the scheme to cover crops entered from the Ohakune district was made at the commencement of the season, but apart from this the main development in the scheme has been in the Canterbury district.

The percentage of rejections is higher than has been the case for a couple of seasons. Particularly is this so in regard to crops rejected on account of the presence of foreign varieties beyond the maximum permissible percentage. In a proportion of cases this rejection has been occasioned by the admixture of varieties due to self-sown plants originating from a previous potato crop. In other cases the natural increase of the Northern Star variety, due to its tendency to produce large numbers of tubers, together with the fact that the owner of the crop has not given attention to the removal of plants of this variety, has led to rejection. It is quite established, however, that the question of foreign varieties can be controlled by the exercise of adequate care on the part of the farmer.

The Aucklander Short Top is still the main variety under certification and is in fact increasing in acreage at a more rapid rate than most other varieties. Next in order is the Dakota variety, while the recent introduction, Inverness Favourite, has risen to fifth in the order of importance in the course of three seasons.

In all, over 3,000 tons of seed potatoes were inspected after grading and accepted as finally certified seed. For the first time an appreciable export of certified seed took place, when approximately 300 tons of hand-picked seed was shipped to South America.

## Brassica Crops.

Owing to a failure of the nucleus stocks, no rape-seed of the Broad Leaf Essex type was sown out to produce certified seed in the 1936–37 season. Three areas of the Giant type, comprising 30 acres, were harvested and produced 111 cwt. of seed, giving an average yield of 411 lb. per acre. All the seed produced was rapidly absorbed into commercial channels.

## General.

The accompanying table gives the quantities of the various seeds certified since the inception of seed certification in 1927 and also shows the estimated value of the seed certified in each season.

It should be noted that this table includes only seed in a machine-dressed or graded condition, and does not include seed harvested but not submitted for machine-dressing, or (in the case of potatoes) tuber inspection.

Persons or firms interested in the complete tabulated results for the season may obtain copies on application to the Director of the Fields Division, Department of Agriculture, Wellington.

*Table giving Quantities of each Seed certified and Estimate of the Total Value of Seed certified in each Season.*

| Seed. | Chief Consideration upon which Certification is based. | | Quantities of Seed finally certified. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1927–28. | 1928–29. | 1929–30. | 1930–31. | 1931–32. | 1932–33. | 1933–34. | 1934–35. | 1935–36. | 1936–37. |
| Potatoes .. .. | Varietal purity, cropping-power, and freedom from virus disease | Tons | 217 | 219 | 511 | 760 | 818 | 938 | 1,806 | 1,821 | 2,845 | 3,132 |
| Wheat .. .. | Varietal purity and freedom from loose and stinking smuts | Bush. | 3,840 | 11,682 | 16,714 | 4,060* | 1,283* | 7,001 | 6,012 | 11,110 | 25,646 | 47,465 |
| White clover .. | Age of pasture, 1928–31; type of clover, 1931–37 | lb. | .. | 10,595 | 69,015 | 67,242 | 6,131* | 33,731 | 20,337 | 93,381 | 56,092 | 460,930 |
| Perennial rye-grass | Genuine perennial type .. .. | Bush. | .. | .. | 17,052 | 45,982 | 81,186 | 245,667 | 119,019 | 182,386 | 279,305 | 129,495 |
| Brown-top .. | Freedom from red-top (*Agrostis palustris*) | lb. | .. | .. | 170,071 | 171,083 | 198,343 | 138,843 | 118,978 | 384,588 | 212,734 | 371,358 |
| Cocksfoot .. | Type as exemplified in the produce of Akaroa Peninsula | „ | .. | .. | .. | .. | 171,720 | 622,765 | 200,560 | 715,982 | 657,319 | 334,374 |
| Red clover .. | Type conforming to that of English-grown Montgomery red clover | „ | .. | .. | .. | .. | 1,550 | 3,763 | 17,263 | 32,193 | 23,620 | 28,140 |
| Brassicas .. .. | Varietal purity and freedom from disease | „ | .. | .. | .. | .. | .. | .. | 22,515 | 522 | 24,503 | 12,432 |
| Italian rye-grass .. | A rapid-growing high-producing type, showing recovery after cutting | Bush. | .. | .. | .. | .. | .. | .. | .. | 5,121 | 6,669 | 12,549 |
| *Phalaris tuberosa* .. | Freedom from other species .. | lb. | .. | .. | .. | .. | .. | .. | .. | .. | 2,701 | 1,533 |
| Estimated value of seeds finally certified .. .. .. | | | £2,070 | £4,889 | £30,328 | £40,048 | £57,358 | £142,585 | £79,018 | £154,725 | £184,501 | £168,845 |

* Reductions accounted for by changes in regulations.

Total estimated value of seed certified (1927–37), £864,367.

# LAMBING PERCENTAGES.

## ESTIMATES FOR THE CURRENT SEASON.

THE following are the estimates of the current season's lambing in New Zealand, computed from estimated average percentages furnished by Inspectors of Stock :—

### NORTH ISLAND.

| County. | Breeding-ewes. | Estimated Percentage of Lambs. | Estimated Number of Lambs. |
|---|---|---|---|
| **AUCKLAND DISTRICT.** | | | |
| Mongonui | 31,033 | 79 | 24,516 |
| Whangaroa | 13,251 | 80 | 10,601 |
| Bay of Islands | 57,814 | 86 | 49,720 |
| Hokianga | 54,267 | 81 | 43,956 |
| Whangarei | 100,038 | 82 | 82,031 |
| Otamatea | 68,258 | 82 | 55,972 |
| Hobson | 69,419 | 83 | 57,618 |
| Rodney | 68,005 | 75 | 51,004 |
| Great Barrier Island | 7,188 | 67 | 4,816 |
| Waitemata | 66,158 | 89 | 58,881 |
| Eden | 2,020 | 85 | 1,717 |
| Manukau | 54,689 | 96 | 52,501 |
| Franklin | 95,631 | 96 | 91,806 |
| Coromandel | 41,918 | 78 | 32,696 |
| Thames | 10,922 | 97 | 10,594 |
| Hauraki Plains | 9,110 | 95 | 8,654 |
| Ohinemuri | 10,456 | 89 | 9,306 |
| Waikato | 85,811 | 96 | 82,379 |
| Raglan | 258,023 | 87 | 224,480 |
| Waipa | 132,659 | 104 | 137,965 |
| Piako | 96,220 | 100 | 96,220 |
| Matamata | 135,066 | 100 | 135,066 |
| Rotorua | 46,199 | 91 | 42,042 |
| Taupo | 6,662 | 90 | 5,996 |
| Taumarunui | 84,118 | 89 | 74,865 |
| Kawhia | 49,484 | 88 | 43,546 |
| Otorohanga | 92,758 | 95 | 88,120 |
| Waitomo | 253,834 | 95 | 241,142 |
| Ohura | 92,244 | 89 | 82,097 |
| Kaitieke | 53,094 | 82 | 43,537 |
| Tauranga | 52,395 | 92 | 48,203 |
| Whakatane | 32,442 | 84 | 27,251 |
| Opotiki | 50,216 | 86 | 43,186 |
| District totals | 2,281,402 | 90·404 | 2,062,484 |
| **GISBORNE - HAWKE'S BAY DISTRICT.** | | | |
| Matakaoa | 66,775 | 83 | 55,423 |
| Waiapu | 252,693 | 71 | 179,412 |
| Uawa | 123,626 | 80 | 98,901 |
| Cook | 455,323 | 82 | 373,365 |
| Waikohu | 358,761 | 81 | 290,596 |
| Wairoa | 376,038 | 81 | 304,591 |
| Hawke's Bay | 912,238 | 70 | 638,567 |
| Waipawa | 346,534 | 77 | 266,831 |
| Waipukurau | 123,177 | 89 | 109,628 |
| Patangata | 476,022 | 75 | 357,016 |
| Weber | 53,863 | 82 | 44,168 |
| Dannevirke | 235,318 | 94 | 221,199 |
| Woodville | 69,271 | 90 | 62,344 |
| Pahiatua | 142,841 | 93 | 132,842 |
| Akitio | 155,950 | 92 | 143,474 |
| **District totals** | **4,148,430** | **79·026** | **3,278,357** |

LAMBING PERCENTAGES—*continued.*

NORTH ISLAND—*continued.*

| County. | Breeding-ewes. | Estimated Percentage of Lambs. | Estimated Number of Lambs. |
|---|---|---|---|
| WELLINGTON DISTRICT | | | |
| Clifton .. .. .. | 57,078 | 92 | 52,512 |
| Taranaki .. .. .. | 18,864 | 99 | 18,675 |
| Inglewood .. .. .. | 35,969 | 98 | 35,249 |
| Egmont .. .. .. | 19,238 | 107 | 20,585 |
| Stratford .. .. .. | 61,415 | 92 | 56,502 |
| Whangamomona .. .. | 46,896 | 90 | 42,206 |
| Eltham .. .. .. | 45,450 | 95 | 43,177 |
| Hawera .. .. .. | 67,884 | 104 | 70,599 |
| Waimate West .. .. | 5,491 | 102 | 5,601 |
| Patea .. .. .. | 196,715 | 96 | 188,846 |
| Waitotara .. .. .. | 139,918 | 95 | 132,922 |
| Waimarino .. .. .. | 155,637 | 87 | 135,404 |
| Wanganui .. .. .. | 282,452 | 91 | 266,031 |
| Rangitikei .. .. .. | 919,546 | 93 | 855,178 |
| Oroua .. .. .. | 203,862 | 107 | 218,133 |
| Kairanga .. .. .. | 106,355 | 96 | 102,221 |
| Kiwitea .. .. .. | 214,800 | 100 | 214,800 |
| Pohangina .. .. .. | 111,537 | 97 | 108,191 |
| Manawatu .. .. .. | 140,574 | 91 | 127,922 |
| Horowhenua .. .. | 114,052 | 95 | 108,349 |
| Hutt .. .. .. | 74,377 | 82 | 60,989 |
| Makara .. .. .. | 47,502 | 73 | 34,676 |
| Featherston .. .. .. | 325,944 | 89 | 290,090 |
| Wairarapa South .. .. | 165,273 | 89 | 147,093 |
| Masterton .. .. .. | 333,570 | 80 | 266,856 |
| Castlepoint .. .. .. | 97,694 | 81 | 79,132 |
| Eketahuna .. .. .. | 109,833 | 81 | 88,965 |
| Mauriceville .. .. .. | 42,630 | 80 | 34,104 |
| District totals .. .. | 4,140,556 | 91·896 | 3,805,008 |
| NORTH ISLAND DISTRICTS. | | | |
| Auckland .. .. .. | 2,281,402 | 90·404 | 2,062,484 |
| Gisborne-Hawke's Bay .. | 4,148,430 | 79·026 | 3,278,357 |
| Wellington .. .. .. | 4,140,556 | 91·896 | 3,805,008 |
| Totals, North Island .. | 10,570,388 | 86·523 | 9,145,849 |

## COMPARISONS WITH PREVIOUS YEARS.

The following table shows the estimates for the current season's lambing in the North Island. together with the figures for the five previous years. The actual number of lambs tailed is also given.

| Year. | Number of Breeding-ewes. | Estimated Average Percentage of Lambing. | Estimated Number of Lambs. | Actual Number of Lambs tailed. |
|---|---|---|---|---|
| 1937 .. | 10,570,388 | 86·52 | 9,145,849 | .. |
| 1936 .. | 10,300,826 | 90·50 | 9,322,476 | 9,423,240 |
| 1935 .. | 9,697,231 | 83·68 | 8,114,361 | 8,500,075 |
| 1934 .. | 9,524,065 | 88·70 | 8,447,643 | 8,555,477 |
| 1933 .. | 9,318,943 | 91·23 | 8,502,050 | 8,385,569 |
| 1932 .. | 9,170,996 | 89·16 | 8,177,657 | 7,088,560 |

## LAMBING PERCENTAGES—*continued.*

## SOUTH ISLAND.

| County. | Breeding-ewes. | Estimated Percentage of Lambs. | Estimated Number of Lambs. |
|---|---|---|---|
| **MARLBOROUGH-NELSON-WESTLAND DISTRICT.** | | | |
| Waimea .. .. .. | 167,487 | 74 | 123,940 |
| Takaka .. .. .. | 26,187 | 69 | 18,069 |
| Collingwood .. .. .. | 12,772 | 82 | 10,473 |
| Buller .. .. .. | 2,901 | 94 | 2,727 |
| Inangahua .. .. .. | 11,284 | 93 | 10,494 |
| Murchison .. .. .. | 33,118 | 78 | 25,832 |
| Grey .. .. .. | 24,732 | 107 | 26,463 |
| Westland .. .. .. | 35,302 | 102 | 36,008 |
| Sounds .. .. .. | 103,681 | 73 | 75,687 |
| Marlborough .. .. | 192,694 | 76 | 146,447 |
| Awatere .. .. .. | 207,210 | 82 | 169,912 |
| District totals .. .. | 817,368 | 79·040 | 646,052 |
| **CANTERBURY-KAIKOURA DISTRICT.** | | | |
| Kaikoura .. .. .. | 113,122 | 86 | 97,285 |
| Amuri .. .. .. | 228,471 | 72 | 164,499 |
| Cheviot .. .. .. | 141,185 | 89 | 125,655 |
| Waipara .. .. .. | 293,468 | 87 | 255,317 |
| Ashley .. .. .. | 65,368 | 84 | 54,909 |
| Kowai .. .. .. | 67,225 | 96 | 64,536 |
| Oxford .. .. .. | 82,881 | 100 | 82,881 |
| Rangiora .. .. .. | 42,383 | 93 | 39,416 |
| Eyre .. .. .. | 58,050 | 100 | 58,050 |
| Tawera .. .. .. | 56,473 | 71 | 40,096 |
| Malvern .. .. .. | 134,973 | 104 | 140,330 |
| Paparua .. .. .. | 35,428 | 105 | 37,199 |
| Waimairi .. .. .. | 4,965 | 94 | 4,667 |
| Heathcote .. .. .. | 9,510 | 89 | 8,464 |
| Akaroa .. .. .. | 95,676 | 107 | 102,373 |
| Mount Herbert .. .. | 41,641 | 99 | 41,225 |
| Wairewa .. .. .. | 73,571 | 104 | 76,514 |
| Halswell .. .. .. | 14,880 | 100 | 14,880 |
| Springs .. .. .. | 28,050 | 101 | 28,331 |
| Ellesmere .. .. .. | 90,046 | 92 | 82,842 |
| Selwyn .. .. .. | 166,785 | 81 | 135,096 |
| Ashburton .. .. .. | 758,496 | 97 | 735,741 |
| Geraldine .. .. .. | 244,225 | 84 | 205,149 |
| Levels .. .. .. | 162,968 | 112 | 182,524 |
| Mackenzie .. .. .. | 320,165 | 86 | 275,342 |
| Waimate .. .. .. | 459,621 | 96 | 441,236 |
| Chatham Islands .. .. | 43,779 | 73 | 31,959 |
| District totals .. .. | 3,833,405 | 91·994 | 3,526,516 |
| **OTAGO DISTRICT.** | | | |
| Waitaki .. .. .. | 451,873 | 94 | 424,761 |
| Maniototo .. .. .. | 252,958 | 91 | 230,192 |
| Vincent .. .. .. | 257,184 | 84 | 216,035 |
| Waihemo .. .. .. | 106,061 | 83 | 88,031 |
| Waikouaiti .. .. .. | 67,727 | 91 | 61,632 |
| Taieri .. .. .. | 167,092 | 86 | 143,699 |
| Peninsula .. .. .. | 12,924 | 98 | 12,666 |
| Clutha .. .. .. | 354,145 | 98 | 347,062 |

## LAMBING PERCENTAGES—*continued.*

### SOUTH ISLAND—*continued.*

| County. | Breeding-ewes. | Estimated Percentage of Lambs. | Estimated Number of Lambs. |
|---|---|---|---|
| OTAGO DISTRICT—*continued.* | | | |
| Tuapeka .. .. .. | 310,562 | 94 | 291,923 |
| Bruce .. .. .. | 204,523 | 91 | 186,116 |
| Lake .. .. .. | 131,849 | 76 | 100,205 |
| Southland .. .. .. | 1,293,029 | 100 | 1,293,029 |
| Wallace .. .. .. | 499,405 | 87 | 434,482 |
| Stewart Island .. .. | 1,584 | 80 | 1,267 |
| District totals .. .. | 4,110,916 | 93·193 | 3,831,100 |
| SOUTH ISLAND DISTRICTS. | | | |
| Canterbury .. .. .. | 3,833,405 | 91·994 | 3,526,516 |
| Marlborough .. .. | 817,368 | 79·040 | 646,052 |
| Otago .. .. .. | 4,110,916 | 93·193 | 3,831,100 |
| Totals, South Island .. | 8,761,689 | 91·348 | 8,003,668 |

The following table shows the estimates for the current season's lambing in the North and South Islands, and also the totals for the Dominion, together with the figures for the five previous years. The actual number of lambs tailed is also given.

| Year. | Number of Breeding-ewes. | Estimated Average Percentage of Lambing. | Estimated Number of Lambs. | Actual Number of Lambs tailed. |
|---|---|---|---|---|
| NORTH ISLAND. | | | | |
| 1937 .. | 10,570,388 | 86·52 | 9,145,849 | .. |
| 1936 .. | 10,300,826 | 90·50 | 9,322,476 | 9,423,240 |
| 1935 .. | 9,697,231 | 83·68 | 8,114,361 | 8,500,075 |
| 1934 .. | 9,524,065 | 88·70 | 8,447,643 | 8,555,477 |
| 1933 .. | 9,318,943 | 91·23 | 8,502,050 | 8,385,569 |
| 1932 .. | 9,170,996 | 89·16 | 8,177,657 | 7,988,569 |
| SOUTH ISLAND. | | | | |
| 1937 .. | 8,761,689 | 91·35 | 8,003,668 | .. |
| 1936 .. | 8,368,135 | 90·10 | 7,539,576 | 7,442,781 |
| 1935 .. | 8,115,186 | 89·45 | 7,259,281 | 7,196,542 |
| 1934 .. | 8,047,361 | 89·88 | 7,232,750 | 7,134,015 |
| 1933 .. | 7,890,756 | 88·14 | 6,955,252 | 6,889,128 |
| 1932 .. | 7,892,064 | 88·42 | 6,978,494 | 7,027,059 |
| DOMINION. | | | | |
| 1937 .. | 19,332,077 | 88·71 | 17,149,517 | .. |
| 1936 .. | 18,668,961 | 90·32 | 16,862,052 | 16,866,021 |
| 1935 .. | 17,812,417 | 86·31 | 15,373,642 | 15,696,617 |
| 1934 .. | 17,571,426 | 89·24 | 15,680,393 | 15,689,492 |
| 1933 .. | 17,209,697 | 89·82 | 15,457,302 | 15,274,697 |
| 1932 .. | 17,063,060 | 88·82 | 15,156,151 | 15,015,628 |

### District Estimates.

The following table gives estimates of the current (1937) season's lambing for the several sheep districts in the Dominion :—

| District. | Number of Breeding-ewes. | Estimated Average Percentage of Lambing. | Estimated Number of Lambs. |
|---|---|---|---|
| Auckland.. .. .. | 2,281,402 | 90·404 | 2,062,484 |
| Gisborne - Hawke's Bay .. | 4,148,430 | 79·026 | 3,278,357 |
| Wellington - West Coast .. | 4,140,556 | 91·896 | 3,805,008 |
| Marlborough-Nelson-Westland | 817,368 | 79·040 | 646,052 |
| Canterbury-Kaikoura .. | 3,833,405 | 91·994 | 3,526,516 |
| Otago (including Southland) | 4,110,916 | 93·193 | 3,831,100 |
| Dominion .. .. | 19,332,077 | 88·711 | 17,149,517 |

# PACKING APPLES AND PEARS IN STANDARD CASES.

Wm. C. Hyde, A T. Douglas, and R. E. Binfield.

## II.

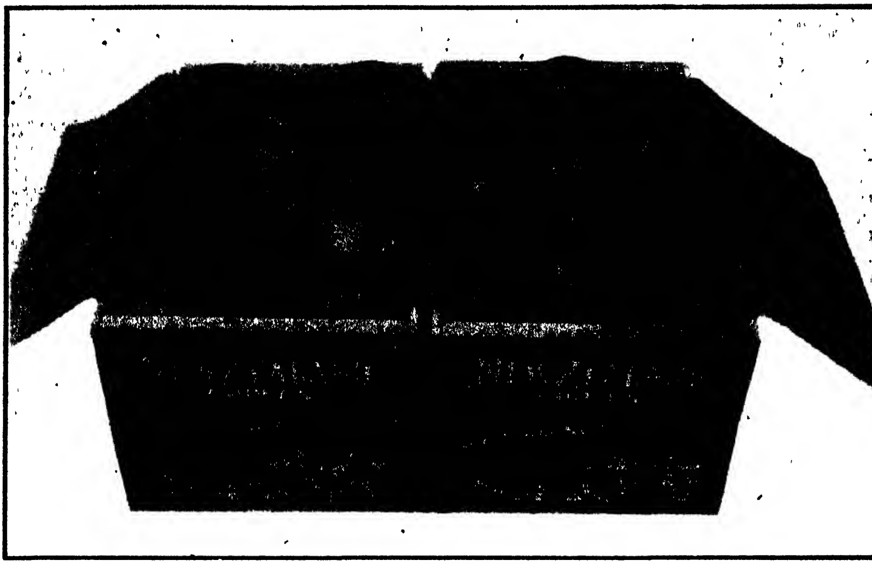
*(Continued from p. 273.)*

As with all operations in the packing-shed, careful arrangements should be made to facilitate the work of packing and avoid unnecessary labour. With this object in view the bottom of the bin of sized and graded fruit, and the bottom of the box into which it is to be packed, should be at least 2 ft. 6 in. from the floor, so the box may be packed without stooping. Such details improve the pack and increase the output.

The box to be packed is placed in a sloping position on a special stand which allows the bottom bulge to be built in as packing proceeds. A tray of wrapping-paper, glazed side up, and held in position by a "paper needle," is provided on the packing-stand, so that it may be readily reached by the left hand of the packer. With the help of a rubber finger-stall on the middle finger on the left hand, the packer takes a wrapping-paper and at the same time an apple with the right hand. He tosses the apple into the middle of the paper, and with the right hand brings up the lower half of the paper to cover the apple. He then turns the palm of the left hand down, and the right hand up with a half-twisting movement on the covered apple between them, and places the apple in the box.

### Position of Apples.

The position of the apples in the box is now to be considered. They are not placed at random, but in a systematic manner, varying slightly, but not in principle, according to the size and shape of the fruit. The system is known as the "pocket" pack, as each apple lies between, instead of directly on, those below. This gives the pack elasticity, prevents bruising, and enables the packer to finish the pack at the right height, which obviously is the most important feature. No case of apples should be nailed down unless the pack is right in that respect.



*Pack 2–1.*

| | |
|---|---|
| Rows, 5 4 | Rows, 5- 5. |
| Layers, 3. | Layers, 3. |
| Count, 41. | Count, 45. |

*Pack 2–2.*

| | |
|---|---|
| Rows, 6–6. | Rows, 5-5. |
| Layers, 4. | Layers, 4. |
| Count, 96. | Count, 80. |

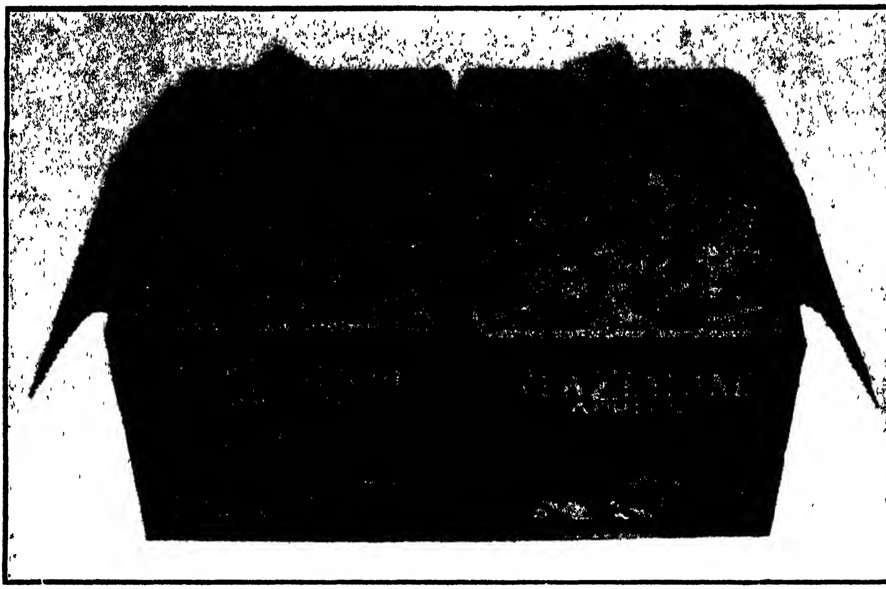
FIG. 7. SHOWING SOME OF THE COUNTS IN THE 2–1 AND 2–2 PACKS WHEN PROPERLY PACKED.

With the box in a sloping position and end on to the packer, if apples measuring 4 in. in diameter from cheek to cheek are wrapped and one placed in each of the lower corners, it will be found there is not sufficient room for the third apple to be placed between them in such a way that it touches the box-end, which is only 11½ in. across. It has to stand an inch or so off the box-end and project some distance in front of the two corner apples, leaving a "pocket" on each side. The fourth apple is placed in the pocket in front of number one, and the fifth apple in front of number two. If the sixth is then placed in front, or above, number three, we again have two pockets which should be filled, and the arrangement continued until the bottom layer is completed. With rather flat apples the number in the rows lengthwise of the case may be five in each; but with a more conical apple it may be 5–4—that is, 5 in each of the outside rows and 4 in the middle row. *The main axis of the apple—that is, the line from stem to calyx—should always be kept parallel with the length of the case, the stem of the fruit always pointing from the packer, except the last apples placed in the layer, which should be reversed, so that the stem-end is turned towards the packer, to avoid stem-punctures.* This pack is known as the *2–1 pack*; by adding these numbers together we get 3, which is the number of layers required to fill the case. The second layer is commenced by placing an apple in the space or pocket formed by the first three apples in the bottom layer.

With rather a smaller apple, say, 3⅝ in. diameter, the three apples would lie snugly side by side against the end of the case, but that would make a "straight" pack instead of the more desirable "diagonal" or pocket pack. In this instance one apple should be placed in the left-hand bottom corner and the second half-way between it and the right-hand corner. By placing the third and fourth apples in the spaces between, number two is made secure in its position, and the layer is completed with apples in the same relative positions. This is known as a *2–2 pack*, and adding the numbers we get 4, which is the number of layers required to fill the case. The second layer is commenced by placing two apples above the spaces in the first layer.

Medium-sized apples, of about 2⅞ in. diameter, four of which lie loosely along the end of a case, but without room for a fifth, make what is known as a *3–2 pack*—that is, a wrapped apple is placed in each corner and one in the middle of the end of the case; the fourth and fifth apples lie in the two spaces between, thus making three pockets or spaces which are filled, and the layer completed with fruits in the same relative position. It takes five layers to fill the box in this way, the second layer being commenced by placing two apples above the two spaces in the bottom layer, next the lower end of the box.

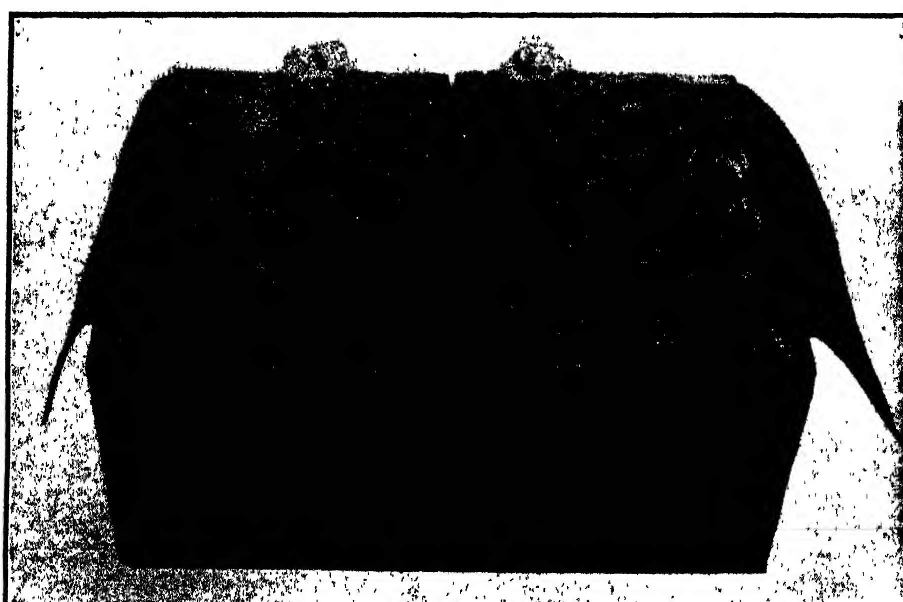
Apples with a diameter of 2¼ in. to 2½ in. are packed by the following method: One is placed in the left-hand bottom corner of the box and two more are placed equidistant in the remaining space, so there are three spaces or pockets for the next row. The layer is then completed with apples in the same relative position. This is known as the *3–3 pack*, and six layers will be required to fill the



*Pack 3-2.*

Rows, 6–5.
Layers, 5.
Count, 138.

Rows, 6–6
Layers, 5.
Count, 150.



*Pack 3–3.*

Rows, 6–5.
Layers, 6.
Count, 198.

Rows, 5–5.
Layers, 6.
Count, 180.

FIG. 8. SHOWING SOME OF THE COUNTS IN THE 3-2 AND 3–3 PACKS.

case. As before stated, all *apples should lie on the cheek with the stem pointing directly from the packer, except the last row in a layer, which should be reversed.*

The following apple packs are generally most suitable for the standard bushel case :—

*Packing Chart for Standard Apple Case.*

| Style of Pack (Crosswise). | Number in Rows (Lengthwise). | Number of Layers (Depth). | Size or Count. | Approximate Sizes. |
|---|---|---|---|---|
| | | | | In. |
| 2–1 .. .. .. | 4–4 | 3 | 36 | 4 |
| 2–1 .. .. .. | 5–4 | 3 | 41 | 4 |
| 2–2 .. .. .. | 3–3 | 4 | 48 | 3⅞ |
| 2–2 .. .. .. | 4–3 | 4 | 56 | 3¾ |
| 2–2 .. .. .. | 4–4 | 4 | 64 | 3⅝ |
| 2–2 .. .. .. | 5–4 | 4 | 72 | 3½ |
| 2–2 .. .. .. | 5–5 | 4 | 80 | 3⅜ |
| 2–2 .. .. .. | 6–5 | 4* | 88 | 3¼ |
| 3–2 .. .. .. | 4–3 | 5† | 88 | 3¼ |
| 2–2 .. .. .. | 6–6 | 4* | 96 | 3 |
| 3–2 .. .. .. | 4–4 | 5 | 100 | 3 |
| 3–2 .. .. .. | 5–4 | 5 | 113 | 2⅞ |
| 3–2 .. .. .. | 5–5 | 5 | 125 | 2¾ |
| 3–2 .. .. .. | 6–5 | 5 | 138 | 2¾ |
| 3–2 .. .. .. | 6–6 | 5 | 150 | 2⅝ |
| 3–3 .. .. .. | 5–4 | 6† | 162 | 2⅝ |
| 3–2 .. .. .. | 7–6 | 5 | 163 | 2⅝ |
| 3–2 .. .. .. | 7–7 | 5‡ | 175 | 2½ |
| 3–3 .. .. .. | 5–5 | 6§ | 180 | 2½ |
| 3–3 .. .. .. | 6–5 | 6 | 198 | 2⅜ |
| 3–3 .. .. .. | 6–6 | 6 | 216 | 2⅜ |
| 3–3 .. .. .. | 7–6 | 6 | 234 | 2¼ |
| 3–3 .. .. .. | 7–7 | 6 | 252 | 2¼ |
| 3–3 .. .. .. | 8–7 | 6 | 270 | 2⅛ |

* For flat apples. † For long apples. ‡ Flat apples only. § All apples.

In all minimum packs no fruit should be smaller than the size indicated for the packs in this chart.

## Meeting the Buyer.

The buyer naturally expects to receive a full case of fruit in good condition. To comply with this specification the packer should finish the case with a smooth surface on the top layer of fruit, the centre being approximately 1½ in. above the edge of the box and the ends about ¾ in. for tight packs and ½ in. for looser packs. These measurements will depend to some extent on the strength of the packer and the tightness of the packing, but when nailed down the pack should be solid, without bruising, with a ¾ in. bulge at the centre, top, and bottom.

The height of the finished surface of fruit in a packed box depends on selecting the correct pack and the size of the pockets. The latter should be carefully adjusted when placing the first layer in the case; and pressing the second layer well into them will retain the size set. The larger-sized apples in each pack, such as the 48 count in the 2–2 pack, and the 100 count in the 3–2 pack, and the 180 count in the 3–3 pack, should be placed rather loose in the bottom layer or the pack

will finish too high and crush when lidded. This is probably the most common cause of a bruised pack. Not only should the bottom layer be loose, but the fruit towards the ends of the case should be looser than that across the centre. If the second layer is then well pressed down, the correct size of the pockets will be maintained and the top will finish at the right height with the requisite bulge. The smaller apples in each pack, however, such as 234 count in the 3-3 pack and 163 count in the 3-2 pack, should be packed tight in order to bring them up sufficiently high at the finish. *Care must always be taken to adjust*

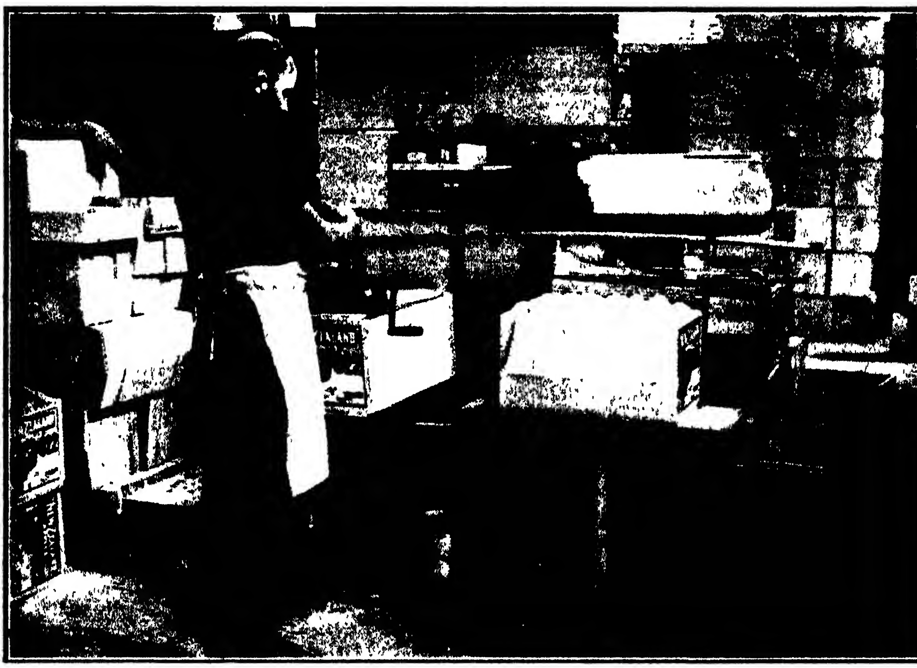


FIG. 9. WITH THE AID OF THE LIDDING-PRESS AND WIRING-MACHINE THE PACK IS COMPLETED.

*the size of the pockets when placing the first layer of fruit in the box.* When two-thirds of that layer is in position the fruit should be pulled down firmly towards the packer without throwing the apples out of alignment; this will close up the pockets somewhat across the centre and provide the necessary bulge if the second layer is pressed well down into the pockets of the first layer in order to retain the size set for the pockets. With loose packs especially there is a tendency for the fruits in the first layer to be closer together at the lower end of the case. If this is not rectified before the second layer is commenced it will be found when the case is filled that the fruit will be higher at the end nearest the packer than at the other end.

## Stamping, Nailing-down, and Wiring.

So soon as a case is packed the packer's card should be inserted and the case then placed on the conveyer—which should be of one of the types illustrated, so that the bottom bulge is protected—where it reaches the nailing-down press. Where packer's cards are not in use it is the standard practice for the packer to mark the count per case in pencil at the bottom right-hand corner of the case. Care, however, should be taken to apply this neatly and legibly for the guidance of the nailer-down. There the box is examined to see that it is sound and all the nails are properly driven, the fruit is packed with a smooth finish, at the right height, and the packer's card is then filed.

The variety, count, and other necessary details which have not been overprinted on the label are then stamped on the case neatly with rubber stamps and indelible ink. The all-round corrugated pad if in use is now folded over tightly to avoid bulging at the sides, if a single pad is used it is placed squarely on, the two-piece lids and cleats are adjusted and held in position by the lidding-press and securely fastened with four nails each end through the cleats into the ends of the case. In doing this the operator, with his hands on the centre of the lid, exerts a pressure as the arms of the press come into operation, which has the effect of distributing the pressure equally through the pack and consolidating it evenly. The box is then released from the press, and, if it is to be exported, it is tightly strapped with wire, applied not more than an inch from each end of the box, and then placed on its side in a stack not more than six cases high awaiting shipment. Soaking cleats in water assists in overcoming splitting during nailing.

## Harvesting the Pear Crop.

Mistakes are commonly made in judging the maturity of pears; possibly because they are judged on the same standard as apples, whereas their behaviour is somewhat different. Ripened on the tree they are of inferior quality, but picked so soon as they are mature, and ripened in a warm, humid atmosphere, the flavour and aroma develop to a maximum extent and the most is made of any qualities of that kind they possess. Experience is necessary for acquiring good judgment as to maturity; probably the most important sign is when the fruit parts from the tree in an easy natural manner when the weight is taken in one's hand and the fruit slightly raised. This behaviour, together with the size of the fruit and the season of the year, are the most useful indicators. Change in the colour of the skin is usually very slight at that stage; a colour-change, however slight, should usually be regarded as an urgent sign for harvesting pears. The harvesting of pears commences towards the end of January. The recognized commercial varieties are ready for picking according to the purpose for which they are required in approximately the following order: Commencing with William's Bon Chretien and Beurré d'Amanlis in the month of January; Louise Bonne de Jersey, Beurré Capiaumont, Beurré Clairgeau, Marie Louise, Beurré Bosc, Conference, Doyenné du Comice, Beurré d'Anjou, Packham's Triumph, Winter Cole, Beurré Diel, Vicar of Winkfield,

Duchesse d'Angoulême, Joséphine de Malines, Glou Morçeau, Giblin's Nelis, Winter Nelis, Keiffer, Beurré Easter, L'Inconnue, and P. Barry—the latter reaching maturity during the month of April.

The class of land and locality in which pears are grown, amount of crop per tree, and weather conditions prevailing during the season are factors which considerably affect the maturing of pears.

## Packing Pears in the Standard Case.

*Making and Labelling the Boxes.*—The standard pear-case differs in size from the standard apple-case in depth only, and is known as the three-quarter pear-case.

The following are the dimensions of the standard pear-case :—

Inside measurement : 8½ in. by 11½ in. by 18 in.

Ends : 8½ in. by 11½ in. by ¾ in. or ⅝ in. (two pieces each planed on the outer side).

Sides : 8½ in. by 19½ in. by $\frac{5}{16}$ in. (two pieces, one board for each side).

Tops and Bottoms : 5½ in. by 19½ in. by $\frac{3}{16}$ in. (four pieces, two each top and bottom).

Cleats : 11½ in. by ¾ in. by $\frac{5}{16}$ in. (four pieces, one across each end both top and bottom).

This case is packed on the wide side of the case.

The specification of the case as regards timber, nailing, labelling, marking, and wiring is practically similar to that for apples.

*Grading and Sizing the Fruit.*—Standard grades of pears and sizes packed are subject to slight alteration each season. Those set for the 1937 export season are as follows :—

"Extra Fancy Grade" : Pears of this grade shall be mature, sound, moderately clear skinned, well formed, carefully hand-picked from the tree, properly wrapped, true to name ; free from disease, skin-puncture, skin broken at stem, and other defects which cause fruit to decay or which are likely to make the fruit unattractive to the consumer.

"Fancy Grade" : Pears of this grade should be mature, sound, well formed, carefully hand-picked from the tree, properly wrapped, true to name ; free from disease, skin-puncture, skin broken at stem, and other defects which cause fruit to decay or which are likely to make the fruit unattractive to the consumer.

Individual fruits of either grade should carry not more than the percentage of blemish or spray injury indicated in the following general list with respect to each variety in the respective grades.

The following varieties of pears are approved for export. The maximum size of pears offered for export shall be 3 in. and the minimum size 2⅛ in.

Sizes to be as in attached list.

| Variety. | Sizes. | | | | Blemish. | | Spray-injury. | |
|---|---|---|---|---|---|---|---|---|
| | Standard Pear-case. | | Trays. | | | | | |
| | Max. | Min. | Max. | Min. | XF, % | F, % | XF, % | F, % |
| Bailey Berg .. .. | 90 | 195 | .. | .. | 1 | 5 | .. | 20 |
| Beacon .. .. | 90 | 195 | .. | .. | 1 | 5 | .. | 20 |
| Beurré Bosc .. .. | 70 | 180 | 18 | 33 | 1 | 5 | .. | 20 |
| Beurré Capiaumont .. | 90 | 195 | .. | .. | 1 | 5 | .. | 20 |
| Beurré Clairgeau .. | 70 | 180 | .. | .. | 1 | 5 | .. | 20 |
| Beurré d'Amanlis | 90 | 195 | .. | .. | 1 | 5 | .. | 20 |
| Beurré d'Anjou .. | 90 | 195 | 18 | 33 | 1 | 5 | .. | 20 |
| Beurré Diel .. .. | 90 | 165 | .. | .. | 1 | 5 | .. | 20 |
| Beurré Easter .. | 90 | 165 | .. | .. | 1 | 5 | .. | 20 |
| Broompark .. .. | 90 | 195 | .. | .. | 1 | 5 | .. | 20 |
| Chaumontel .. .. | 90 | 195 | .. | .. | 1 | 5 | .. | 20 |
| Conference .. .. | 80 | 180 | .. | .. | 1 | 5 | .. | 20 |
| Doyenné du Comice .. | 80 | 195 | 18 | 33 | 1 | 5 | .. | 20 |
| Duchesse d'Angoulême | 70 | 180 | .. | .. | 1 | 5 | .. | 20 |
| Elizabeth Cole .. | 90 | 210 | .. | .. | 1 | 5 | .. | 20 |
| Giblin's Nelis .. | 90 | 195 | .. | .. | 1 | 5 | .. | 20 |
| Glou Morçeau .. | 90 | 165 | .. | .. | 1 | 5 | .. | 20 |
| Harrington's Victoria .. | 70 | 180 | .. | .. | 1 | 5 | .. | 20 |
| Joséphine de Malines .. | 90 | 210 | .. | .. | 1 | 5 | .. | 20 |
| Keiffer .. .. | 70 | 180 | .. | .. | 1 | 5 | .. | 20 |
| L'Inconnue .. .. | 90 | 210 | .. | .. | 1 | 5 | .. | 20 |
| Louise Bonne de Jersey | 90 | 195 | .. | .. | 1 | 5 | .. | 20 |
| Madam Cole .. .. | 90 | 210 | .. | .. | 1 | 5 | .. | 20 |
| Marie Louise .. | 90 | 195 | 18 | 33 | 1 | 5 | .. | 20 |
| Packham's Triumph .. | 80 | 180 | .. | .. | 1 | 5 | .. | 20 |
| P. Barry .. .. | 70 | 180 | .. | .. | 1 | 5 | .. | 20 |
| Twyford Monarch .. | 90 | 195 | .. | .. | 1 | 5 | .. | 20 |
| Vicar of Winkfield .. | 70 | 180 | .. | .. | 1 | 5 | .. | 20 |
| Winter Cole .. .. | 90 | 210 | .. | .. | 1 | 5 | .. | 20 |
| Winter Nelis .. .. | 90 | 210 | .. | .. | 1 | 5 | .. | 20 |

Only those varieties for which tray sizes are designated are acceptable packed in trays.

Pears in trays to be packed in wood-wool or in all-round corrugated straw-board wrap; strawboard to be of dimensions 30 in. by 17½ in. (approximately). Pears which are against the ends of the tray to be double-wrapped; the tray to be of a depth suitable to the size of pear, but any slack in the pack to be taken up with an extra pad of corrugated strawboard or wood-wool. Wrapping-paper of sizes 10 in. or 11 in. by 11 in. to be used for pears in trays, the size of wrap to be according to the size of pear. Where 11 in. by 11 in. is specified, 10 in. by 10 in. double wrapping may be substituted.

All pears in standard pear-cases to be packed with an all-round wrap of corrugated strawboard.

### Packing the Box.

What has been written about the packing of apples is also applicable to pears; the principle of the system is the same although the actual packs themselves are different.

In pear-packing the same diagonal pocket is used. When placing the pears in the case after wrapping, all stalks should be pointing away from the packer towards the opposite end of the case, with the exception of the last pears placed in the layer, which should be reversed with calyx to the end of the case to obviate stalk damage. It is essential also that the two end rows of pears in each layer should be double-wrapped to obviate chafing on the end of the case.

Extra care in the handling of pears, especially when the fruit is being handled in the bins, is necessary. Owing to this class of fruit having longer stalks generally in comparison to apples, more damage is liable to accrue from stem punctures.

Below is given two pear-packing charts; one applies to round varieties of pears, such as Winter Cole, Winter Nelis, &c., and the other applies to elongated varieties, such as Beurré Bosc, P. Barry, and Vicar of Winkfield, &c.

*Packing Chart for Standard Pear-case.*

*Round Varieties.*

| Style of Pack. | Number in Rows (Lengthwise). | Number of Tiers. | Count. | Approximate Sizes. |
|---|---|---|---|---|
| | | | | In. |
| 3–2 .. .. .. | 4–3 | 4 | 70 | 3¼ |
| 3–2 .. .. .. | 4–4 | 4 | 80 | 3⅛ |
| 3–2 .. .. .. | 5–4 | 4 | 90 | 3 |
| 3–2 .. .. .. | 5–5 | 4 | 100 | 2⅞ |
| 3–2 .. .. .. | 6–5 | 4 | 110 | 2¾* |
| 3–2 .. .. .. | 6–6 | 4 | 120 | 2¾ |
| 3–3 .. .. .. | 4–4 | 5 | 120 | 2¾ |
| 3–2 .. .. .. | 7–6 | 4 | 130 | 2⅝ |
| 3–3 .. .. .. | 5–4 | 5 | 135 | 2½* |
| 3–3 .. .. .. | 5–5 | 5 | 150 | 2½ |
| 3–3 .. .. .. | 6–5 | 5 | 165 | 2⅜ |
| 3–3 .. .. .. | 6–6 | 5 | 180 | 2¼ |
| 3–3 .. .. .. | 7–6 | 5 | 195 | 2¼ |
| 3–3 .. .. .. | 7–7 | 5 | 210 | 2⅛ |
| 4–3 .. .. .. | 6–6 | 5 | 210 | 2⅛ |

*Indicates increased variation upwards.

*Elongated Varieties.*

| Style of Pack. | Number in Rows. | Number of Tiers. | Count. | Approximate Sizes. |
|---|---|---|---|---|
| | | | | In. |
| 3–2 .. .. .. | 4–3 | 4 | 70 | 3 |
| 3–2 .. .. .. | 4–4 | 4 | 80 | 2⅞ |
| 3–2 .. .. .. | 5–4 | 4 | 90 | 2¾ |
| 3–3 .. .. .. | 4–3 | 5 | 105 | 2⅝* |
| 3–2 .. .. .. | 6–5 | 4 | 110 | 2⅝ |
| 3–3 .. .. | 4–4 | 5 | 120 | 2½* |
| 3–3 .. .. .. | 5–4 | 5 | 135 | 2½ |
| 3–3 .. .. .. | 5–5 | 5 | 150 | 2⅜ |
| 3–3 .. .. .. | 6–5 | 5 | 165 | 2¼ |
| 3–3 .. .. .. | 6–6 | 5 | 180 | 2⅛ |

*Indicates increased variation upwards.

### Storage and Shipping.

The fruits are seriously depreciated if large quantities are stacked close and left in an unventilated chamber for even a short period. This is particularly dangerous for early and mid-season fruit likely to ripen quickly and intended for shipment for a long distance. The packing-shed must be well ventilated and the stacks of fruit built so the air can circulate freely through them even when the packing-shed doors are closed. During the summer period especially the packed fruit should be despatched to the cool-store so soon as possible, as the heat and humidity at that season are liable to unduly hasten ripening.

Fungus diseases are responsible for serious losses in pears when they are cool stored for long periods. Grey mould *(Botrytis)* is often prevalent on the Winter Cole variety. This disease may be controlled to a considerable extent by the application of Bordeaux mixture a few days prior to picking the crop, by using only clean, dry cases for storing, and the wrapping of the fruit in copper-sulphate-treated wraps.

Losses of fruit from decay in storage and transit are to a great extent due to fungous spores getting access to the tissues of the fruit through injuries to the skin; commonly these are very slight and caused by bruising or nail marks which are hardly discernible and not noticed when they occur. The injury, however, is sufficiently large to provide ready entrance for the spores to grow and destroy the fruit. *This will be avoided by handling the fruit with care at all times, and packing and storing it under clean conditions.* The latter may be secured by sweeping up the packing-shed every afternoon when it is in use, promptly feeding waste fruit to stock; and spraying, washing, or fumigating the packing-shed and store with a reliable fungicide so soon as the season is finished. Attention should be given to the vicinity as well as the interior of the buildings.

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# WINTON EXPERIMENTAL AND DEMONSTRATION FARM.

## SEASON 1936-37.

A. Stuart, Instructor in Agriculture, Invercargill.

The past season has been one of the wettest experienced for many years, there being very little summer weather experienced. These conditions resulted in a very good growth of grass, although it was somewhat soft and lacking in quality. On account of the wet spring, the preparation of land for cropping was very much delayed, and the seed-bed at sowing-time was not all that could have been desired. The continuation of the wet conditions, with the soil lying in a wet semi-waterlogged condition most of the season, was rather disastrous to root and fodder crops, which were very late and heavily infected with disease. Oat crops were quite good, but great difficulty was experienced in getting them harvested.

Butterfat showed an increase of 1,178 lb., and this increase was largely due to the pasture-growth, which ensured a plentiful supply of feed throughout the season. The herd was increased from thirty-three to thirty-five. Only six calves were reared, compared with ten the previous year. Eighty-one breeding-ewes were carried, and ninety-seven lambs were got away as fats.

Towards the end of the season the committee went into ways and means of improving the experimental status of the farm, and as a result of its deliberations decided to change over from dairying to sheep. It was felt that running the farm as a dairy-farm was not conducive to extensive experimental work, and, with the exception of one or two experiments of a minor nature, the farm was more of a commercial dairy-farm than an experimental farm. There are numerous successful commercial dairy-farms in Southland, so that there is no necessity to have a demonstration farm dealing with the straight-out commercial aspects of dairy farming, but that a growing need for a farm that can be almost entirely devoted to experimental work where trials in connection with pastures and crops can be undertaken. In connection with such trials it was felt that sheep offered a better medium of measuring experimental results than did dairy cows, as with this latter class of stock it is not advisable to subject them to experimental conditions when the farm authorities require to rely on them for the farm finance. Sheep on the other hand lend themselves more to the ups and downs of grazing that must be associated with certain trials, and do not react financially to the same extent as do dairy cows, or, in other words, they will stand more abuse than the dairy cow without causing such a heavy loss in revenue. The committee recognize that the revenue from sheep will probably not be as great as that from dairy cows, but realize the necessity for development in experimentation, and are prepared to make this sacrifice in the interests of progress. In changing over to sheep the committee are by no means introducing a type of farming new to the Winton district, for actually fat-lamb production is more extensive in this area than is the production of butterfat. The time is quite opportune, also, to do some intensive experimental work in connection with the fat-lamb business both from the point of view of breeds and in connection with animal health.

## Root Crops.

Various trials were planned in connection with swedes and turnips, but owing to the late sowing, coupled with the wet cold season, this crop was practically a failure, and the experimental work was rendered null and void.

## Oats.

A feature of interest was the growing of a block of Resistance oats. This variety is giving promise of excellent performance in Southland. The crop was spring-sown, and the block was situated in the centre of a field of Gartons Abundance. The Resistance was definitely better headed than the Gartons, although shorter in the straw, and approximately a week later maturing. There was ample evidence of its ability to stand up under adverse conditions, as it did not lodge, while the Gartons went down badly in parts. This characteristic is a valuable one for many Southland soil types.

### Certified versus Uncertified Rye-grass.

This trial, which was put down in the spring of 1933, was planned to determine the relative carrying-capacity and productive capabilities of the certified rye-grass and the uncertified type (see *Journal of Agriculture*, February, 1937). During the past season the area sown with the certified rye-grass has again carried more stock and further increased the production of butterfat when compared with the area sown with uncertified rye-grass. Details are as follows :—

| Month. | Certified Rye-grass. | | Uncertified Rye-grass. | |
|---|---|---|---|---|
| | Cowdays per Acre. | Butterfat per Acre. | Cowdays per Acre. | Butterfat per Acre. |
| 1936. | | | | |
| September .. .. .. | 21·6 | 22·2 | 15·2 | 15·9 |
| October .. .. .. | 38·8 | 42·39 | 22·8 | 24·36 |
| November .. .. .. | 38·4 | 42·86 | 26·0 | 30·77 |
| December .. .. .. | 54·4 | 57·46 | 41·2 | 43·17 |
| 1937 | | | | |
| January .. .. .. | 56·0 | 55·05 | 28·0 | 26·29 |
| February .. .. .. | 56·0 | 45·55 | 28·0 | 22·89 |
| March .. .. .. | 27·8 | 19·45 | 14·0 | 9·79 |
| April .. .. .. .. | 42·0 | 29·49 | 18·6 | 10·04 |
| May .. .. .. .. | 6·5 | 3·76 | Nil | Nil |
| June .. .. .. .. | 4·0 | 2·14 | Nil | Nil |
| July and August .. .. | Nil | Nil | Nil | Nil |
| Total for year .. .. | 345·5 | 320·35 | 193·8 | 183·21 |
| Total to date since first grazed.. | 1,068·0 | 904·95 | 706·0 | 625·81 |

In addition 21·1 dry-stock days per acre have been obtained from the certified rye-grass, and 21·6 dry-stock days per acre from the uncertified rye-grass.

In June last an analysis of these two pastures was made and the result was as follows :—

| — | Bare Ground. | Rye-grass. | White Clover. | Other Grasses. | Weeds. |
|---|---|---|---|---|---|
| Certified .. .. | 23 | 49 | 23 | 29 | 0 |
| Uncertified .. .. | 22 | 19 | 38 | 27 | 12 |

At the time of writing the certified area presents a vigorous sward of rye-grass and white clover, although a few thistles and ragwort plants have made an appearance. White clover is dominant on the uncertified area, and the sward is rather open in places, giving entry to considerable quantities of thistles, ragwort, and brown-top in particular, together with other weed grasses.

### Persistency of Certified Rye-grass.

The experiment where 200 plots of different rye-grass strains were sown was carried on another season, and further demonstrates the persistency of the certified strains of rye-grass. Practically all of the plots sown with uncertified rye-grass have deteriorated to such an extent that rye-grass is practically non-existent in them, and the sward is composed of a little clover, much inferior grass, and weeds, and is very open and low in production.

### REACTION OF PASTURES TO GRAZING AND HAYING.

In the spring of 1934 two areas were sown down with similar plots to study the reaction of the various species to haying and grazing respectively. One of these areas has been hayed during the past two seasons with intermittent grazings, between the hayings, while the other area has been grazed intermittently right through and not closed for hay at all. These plots were recently point analysed with the following results:—

| | Area hayed. | Area grazed. |
|---|---|---|
| Bare ground | 20·0 | 13·0 |
| Rye-grass | 62·5 | 64·0 |
| White clover | 21·0 | 50·0 |
| Red clover | 16·5 | 6·5 |
| Cocksfoot | 16·5 | 3·5 |
| Goose-grass | 9·0 | .. |
| *Poa annua* | .. | 8·0 |
| Sweet vernal | 1·0 | 1·0 |
| Thistles | 0·5 | .. |

The interesting points disclosed by this analysis are—(1) Haying has resulted in the sward opening up slightly; (2) there has been no significant change in the rye-grass content; (3) white clover has been severely checked by haying, while the red-clover content has increased; (4) grazing has been detrimental to cocksfoot; (5) goose-grass has thrived under haying, while *Poa annua* has appeared with grazing.

### RYE-GRASS GERMINATION TROUBLE.

In the spring of 1934, 314 strains of rye-grass were sown in individual plots to ascertain whether there did exist any strains of rye-grass that were immune to the fungus trouble that is associated with the seed harvested from the certified type of rye-grass in Southland in wet seasons. During the 1935–36 harvest the season was a good one for harvesting, the weather being dry, and as a result there was little trouble with the germination of any seed harvested. During the last season, however, wet conditions prevailed and much seed was ruined by the fungus. The plots were all harvested and the seed sent to the Department of Agriculture's Seed-testing Station, but unfortunately no results are yet to hand.

### TIMOTHY STRAINS.

Thirty-five strains of Timothy were sown in 1934, to study the growth and production of the different strains under Southland conditions. There are some outstanding differences between some of these strains, and the plots were harvested so that larger plots can be sown, when the better strains will be studied under pasture-grazing conditions.

### ACKNOWLEDGMENT.

Mr. D. H. McLean (Chairman), Messrs. J. J. Blakie, H. Carswell, and J. G. Hazlett, relinquished their places on the farm committee early in the year, after long and arduous service, and the following members were elected: Messrs. J. H. Thomson (Chairman), J. Ewan, R. King, and Dr. P. Gow.

The committee again wishes to acknowledge the material assistance received from the R. M. McKinnon Trust, and the subsidy from the Department of Agriculture.

# THE COMMERCIALIZATION OF HYBRID VIGOUR IN THE TOMATO.

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SUMMARY.

(1) SEVEN varieties of tomatoes reasonably distinct in type were intercrossed in season 1935–36, and the first-generation hybrids were grown in season 1936–37, with appropriate parent plants as controls.

(2) Out of twenty-nine cross-pollinations made, twenty-seven gave hybrids yielding more than either parent. The two remaining crosses gave hybrids intermediate in yield but closely approaching that of the higher-yielding parent.

(3) Seventeen of the hybrids were earlier than the parent varieties, eleven were intermediate in maturity, and one was later.

(4) Hybrids from crosses between varieties with dissimilar characteristics gave a greater expression of hybrid vigour than hybrids from crosses between less dissimilar varieties. The one late hybrid was from a cross between two very similar early types.

(5) The increases obtained would seem to warrant the use of first-generation hybrid seed by commercial growers, as the labour entailed in producing such seed is comparatively small.

(6) It is probable that trial crosses would have to be made by the growers in each district to produce the type of hybrid most suitable for that district.

The tomato is normally a self-fertilized plant. Cross-pollination between varieties, especially if they are of distinct types, produces a measure of heterosis or hybrid vigour in the first-generation hybrid. Owing to subsequent segregation, this initial vigour is diminished in the later generations of the cross. The possibility of commercializing hybrid vigour depends upon its extent, and on the cost of producing hybrid seed. As about 200 seeds are produced from one tomato, the method offers practical possibilities, provided that it is possible to obtain large increases in yield, and/or a hastening of maturity.

## SEASONS 1933–35.

(For a fuller account see J. W. Hadfield and R. A. Calder(1).)

Experiments were commenced in New Zealand in 1933 to investigate the degree of hybrid vigour obtainable in the tomato, and the possibility of its commercialization. Four varieties of tomatoes were intercrossed, and the progeny grown in season 1934–35, at Palmerston North, with their respective parents as controls. Weighings of fruit were made throughout the season, allowing a determination both of periodic and of total yield.

The results indicated that, in certain crosses, the yield was increased beyond either parent, and also that in some cases there was a hastening of maturity. It was found that crosses between dissimilar varieties gave a greater expression of hybrid vigour than between those of similar type, thus confirming the results of L. Alabouvette and A. Titard(2). In the above experiment three of

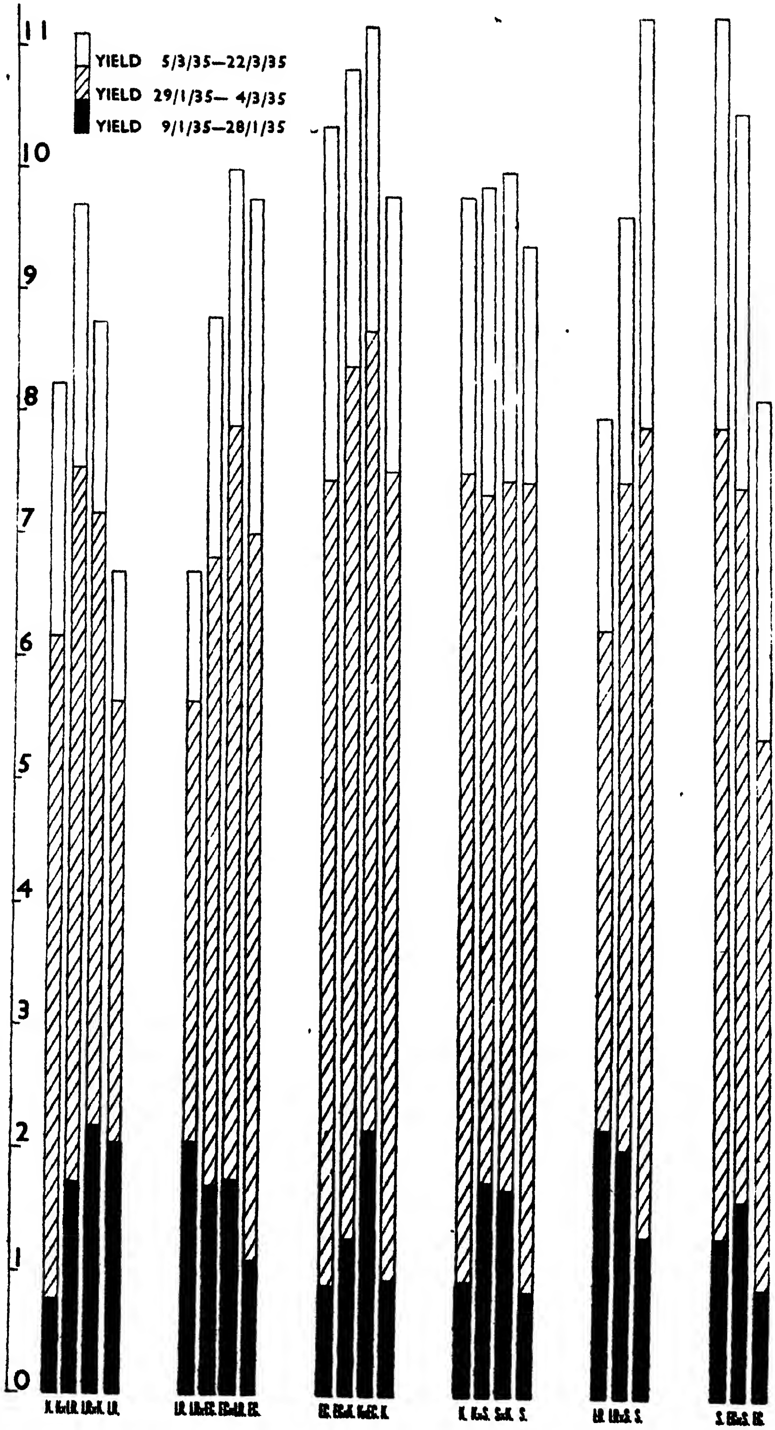


FIG. 1. GRAPH SHOWING COMPARATIVE YIELDS PER PLANT IN THREE HARVEST PERIODS FROM FOUR VARIETIES AND THEIR HYBRIDS DURING 1934–35.

E.C. = Early Cluster, K. = Kondine, L.R. = Large Red, S. = Sunrise.

the four varieties used were of similar type, and gave little increase in yield over the parents (Fig. 1). It was resolved to continue the experiment in an endeavour to discover more satisfactory combinations. For this purpose a larger number of varieties which showed greater variation in type were used.

## Seasons 1935–37.

During season 1935–36 the following varieties of tomatoes were grown and cross-pollinated in as many combinations as possible: Abundance, Burwood, Earliana, Early Long Keeper, Kondine, Marglobe, and Market Favourite. Seed was obtained from the majority of crosses for trial in the 1936–37 season.

The young plants were planted out in November, 1936, staked, and pruned to a single stem in a manner similar to that adopted by the commercial grower. Each plot consisted of five plants, the hybrid plot being grown alongside the plots of the parent varieties, and at least four replications of each were planted where sufficient plants were available. Fruit was picked and weighed when it showed colour, up to three pickings per week being necessary in the middle of the season. There were twenty-four weighings altogether, and, by grouping these into periods, it is possible to obtain a measure of the relative earliness of the varieties and their hybrids.

## General Observations.

The 1936–37 season was particularly unfavourable for tomato-growing in the Palmerston North district. The total rainfall and average temperatures were about normal, but the frequent occurrence of cold, wet, windy periods markedly reduced the number of sunshine hours. As a result, the crop made slow growth, the yields were poor, and the fruit ripened with difficulty.

In general the hybrid plants were more robust than the parents. Where the height of the two parents was similar, the hybrid was taller than either. Where one parent was much taller than the other, the hybrid was as tall, or very nearly as tall, as the tall parent.

Most of the hybrid plants gave a higher yield than the parent varieties. A majority gave also an increase in earliness measured as fruit picked in the first month of harvest. In only one case, in which two varieties crossed were similar in type, was the hybrid of later maturity than both parents.

In most cases the fruit was as high in quality as that of the parents, but the season was such that the fruit of even the standard varieties used was somewhat inferior in this respect. There was a tendency for the fruit to exhibit a strong resemblance to the maternal parent.

Summarized, the position was as follows:—

Number of crosses made = 29.

Number giving an increase in yield over both parents = 27.

Average increase in yield of these twenty-seven hybrids over the parents = 104·6 per cent.

Average increase in yield of all hybrids over the parents = 95 per cent.

Number giving yield intermediate between parents = 2.
Number giving lower yield than both parents = 0.
Number of crosses earlier than both parents = 17.
Average increase in yield of these seventeen hybrids over both parents in the first month of harvest = 144 per cent.
Number intermediate in maturity between parents = 11.
Number later than both parents = 1.

As yield and maturity are the two most important factors, these will be considered in relation to each cross. The twenty-four weighings are presented in three harvest periods and as a total. The season was very late, and hence the first period of harvest extended up to 13th March, 1937. During this period tomatoes were relatively scarce and retailed in the local market at about 8d. per pound. The second period, which was from 14th March to 13th April gave the heaviest yield. The market price during this period was from 4d. to 6d. per pound. The final period was from 14th to 30th April, when all fruit was picked owing to the onset of frosts. The retail price had dropped to 2d. to 3d. per pound.

The significance of early maturity is very obvious, since the monetary value of any increased yield obtained during the first period is so much greater than that of a corresponding increase later in the season.

Yields were much below those normally experienced in the district. However, the results would indicate that the hybrid plants were not so much affected by the adverse conditions as were the parent varieties.

The yields given are in each case the average of the several replications, each of five plants. In all cases the maternal parent of a cross is mentioned first. Notes are added on each cross, including a short description of fruit quality. The yields are summarized in Figs. 2 and 3.

*Table 1.—Marglobe × Kondine.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1 | 2 | 3. | Total |
| Marglobe .. .. .. | 1·11 | 3·74 | 1·16 | 6·01 |
| Marglobe × Kondine .. .. | 1·50 | 6·66 | 3·56 | 11·72 |
| Kondine × Marglobe .. .. | 1·71 | 4·77 | 1·66 | 8·14 |
| Kondine .. .. .. | 1·47 | 5·18 | 1·86 | 8·51 |

Kondine was the heavier-yielding and earlier parent. Marglobe × Kondine was as early as Kondine and yielded more heavily. Kondine × Marglobe was very similar to Kondine in total yield and maturity.

The fruit-quality was generally good and up to the standard of Kondine. Marglobe tended to crack badly round the top of the fruit, and a few of the Marglobe × Kondine hybrids exhibited this fault.

*Table 2.—Kondine × Market Favourite.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Kondine .. .. .. | 1·47 | 5·18 | 1·86 | 8·51 |
| Kondine × Market Favourite .. | 2·69 | 5·90 | 4·47 | 13·06 |
| Market Favourite × Kondine .. | 2·44 | 7·03 | 4·72 | 14·19 |
| Market Favourite .. .. | 3·61 | 3·40 | 1·66 | 8·67 |

Both parents had a similar total yield, but Market Favourite was decidedly the earlier. The hybrids were intermediate in maturity, their higher yields in the second and third periods giving them a total

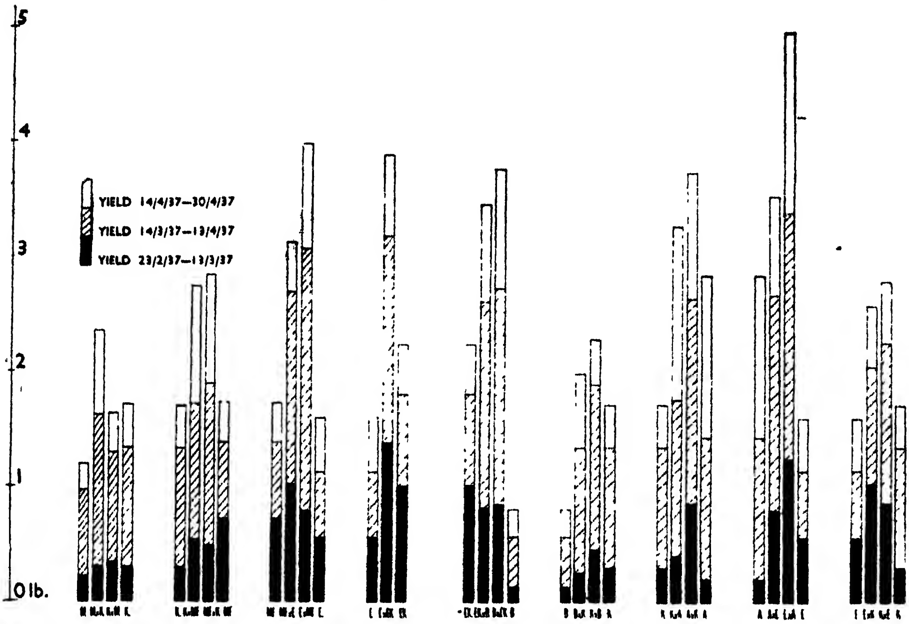


FIG. 2. GRAPH SHOWING COMPARATIVE YIELDS PER PLANT IN THREE HARVEST PERIODS FROM VARIETIES AND HYBRIDS DURING 1936–37.

A. = Abundance, B. = Burwood, E. = Earliana, E.L.K. = Early Long Keeper, K. = Kondine, M. = Marglobe, M.F. = Market Favourite.

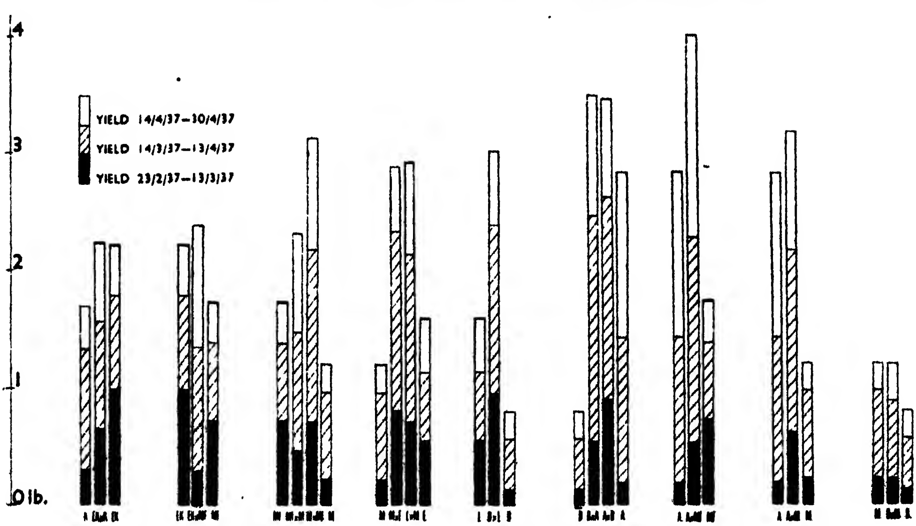


FIG. 3. CONTINUATION OF FIG. 2.

yield greater than either parent. The fruit-quality of Kondine × Market Favourite was good, but that from the reciprocal was not so satisfactory. Both gave fruit medium in size.

*Table 3.—Market Favourite × Earliana.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Market Favourite .. .. | 3·61 | 3·40 | 1·66 | 8·67 |
| Market Favourite × Earliana .. | 5·12 | 8·31 | 2·19 | 15·62 |
| Earliana × Market Favourite .. | 3·94 | 11·34 | 4·62 | 19·90 |
| Earliana .. .. .. | 2·75 | 2·90 | 2·28 | 7·93 |

The two parents gave somewhat similar yields, but, while both were early types, Market Favourite was the earlier one. Each of the hybrids was earlier than either parent, with total yields 80 per cent. and 130 per cent. respectively above Market Favourite. Fruit-size was medium to large, and of good quality.

*Table 4.—Earliana × Early Long Keeper.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total |
| Earliana .. .. .. | 2·75 | 2·90 | 2·28 | 7·93 |
| Earliana × Early Long Keeper .. | 6·87 | 9·04 | 3·38 | 19·29 |
| Early Long Keeper .. .. | 4·95 | 4·01 | 2·09 | 11·05 |

Early Long Keeper was a heavy-yielding, very early variety. Yet the hybrid was much earlier than either parent, and yielded roughly 75 per cent. more fruit of fairly good quality and of a size similar to the parents. The reciprocal was not available.

*Table 5.—Early Long Keeper × Burwood.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Early Long Keeper .. .. | 4·95 | 4·01 | 2·09 | 11·05 |
| Early Long Keeper × Burwood .. | 4·0 | 9·00 | 4·19 | 17·19 |
| Burwood × Early Long Keeper .. | 4·22 | 9·37 | 5·16 | 18·75 |
| Burwood .. .. .. | 0·66 | 2·16 | 1·14 | 3·96 |

Burwood produced low yields in all periods. Yet its hybrids produced almost as much fruit as Early Long Keeper in the early period, and at least twice as much in periods 2 and 3. As a result, total yields were 55 per cent. and 70 per cent. respectively above Early Long Keeper. However, the fruit was of rather poor quality, many being hollow. Fruit-size was medium to large.

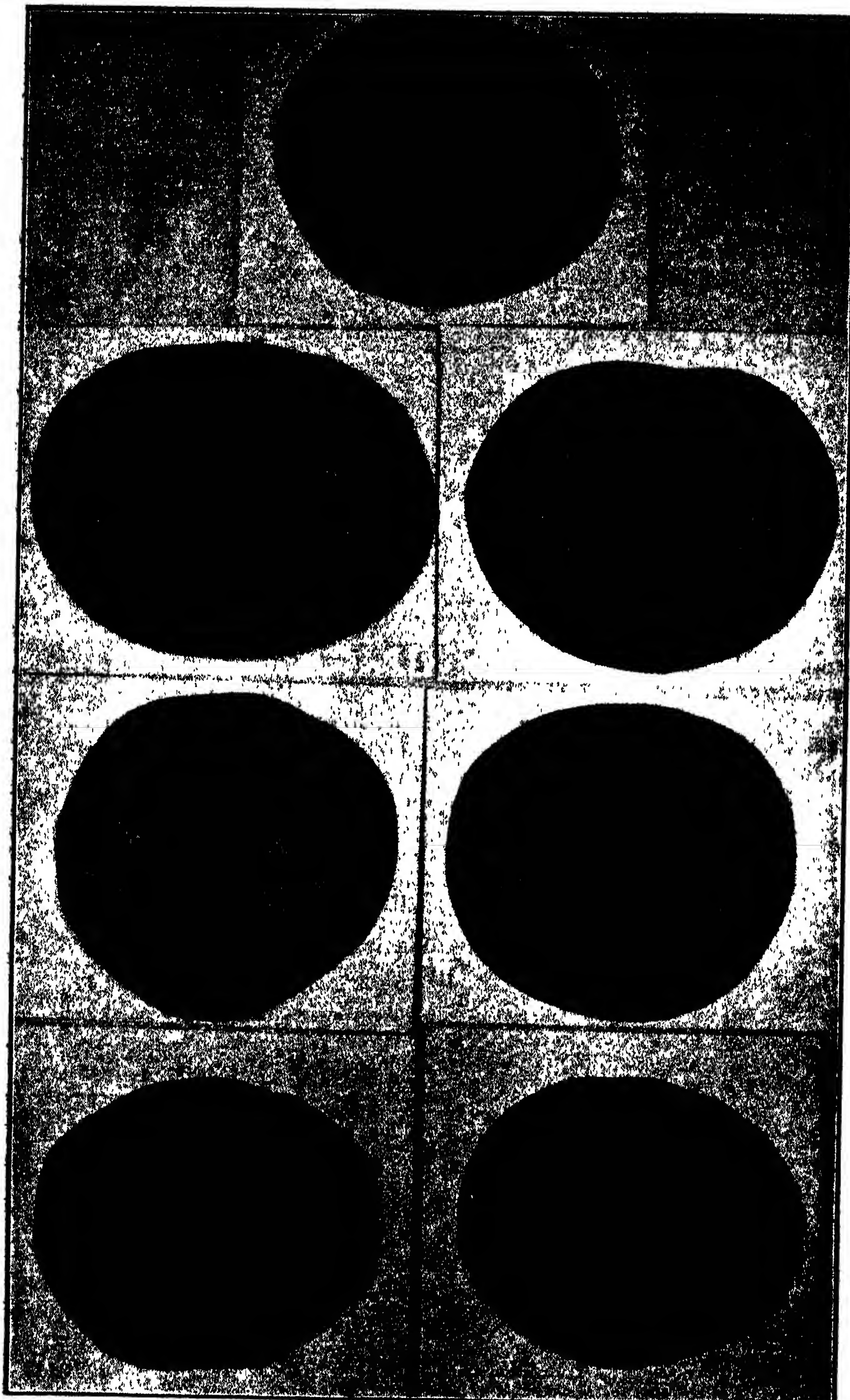

FIG. 4.

Top: Kondine. Left: Kondine × Market Favourite (upper), Market Favourite × Kondine, Market Favourite. Right: Kondine × Earliana (upper), Earliana × Kondine, Earliana.

*Table 6.—Burwood × Kondine.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Burwood .. .. .. | 0·66 | 2·16 | 1·14 | 3·96 |
| Burwood × Kondine .. .. | 1·25 | 5·44 | 3·22 | 9·91 |
| Kondine × Burwood .. .. | 2·22 | 7·19 | 1·90 | 11·31 |
| Kondine .. .. .. | 1·47 | 5·18 | 1·86 | 8·51 |

Both hybrids produced a higher total yield than Kondine, but only one, Kondine × Burwood, was earlier than both parents. The fruit-quality was fair to good, and the size medium.

*Table 7.—Kondine × Abundance.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Kondine .. .. .. | 1·47 | 5·18 | 1·86 | 8·51 |
| Kondine × Abundance .. .. | 1·96 | 6·77 | 7·53 | 16·26 |
| Abundance × Kondine .. .. | 4·28 | 8·81 | 5·45 | 18·54 |
| Abundance .. .. .. | 0·97 | 6·14 | 6·97 | 14·08 |

Abundance was a heavy-yielding, late-maturing variety, producing an abundance of small but well-shaped fruits. The hybrids were earlier than either parent, and produced a greater total yield. The fruit was of good quality, but there was a tendency for the small-fruit size of Abundance to be inherited.

*Table 8.—Abundance × Earliana.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Abundance .. .. .. | 0·97 | 6·14 | 6·97 | 14·08 |
| Abundance × Earliana .. .. | 3·94 | 9·34 | 4·25 | 17·53 |
| Earliana × Abundance .. .. | 6·19 | 10·66 | 7·81 | 24·66 |
| Earliana .. .. .. | 2·75 | 2·90 | 2·28 | 7·93 |

In this case both the hybrids were much earlier than either parent, and produced a much greater total yield. The cross Earliana × Abundance produced the highest-yielding plots in the trial. The fruit was of good quality, though rather small in size. Earliana × Abundance showed some cracking around the top of the fruit.

*Table 9.—Earliana × Kondine.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Earliana .. .. .. | 2·75 | 2·90 | 2·28 | 7·93 |
| Earliana × Kondine .. .. | 5·09 | 5·09 | 2·63 | 12·81 |
| Kondine × Earliana .. .. | 4·22 | 6·97 | 2·63 | 13·82 |
| Kondine .. .. .. | 1·47 | 5·18 | 1·86 | 8·51 |

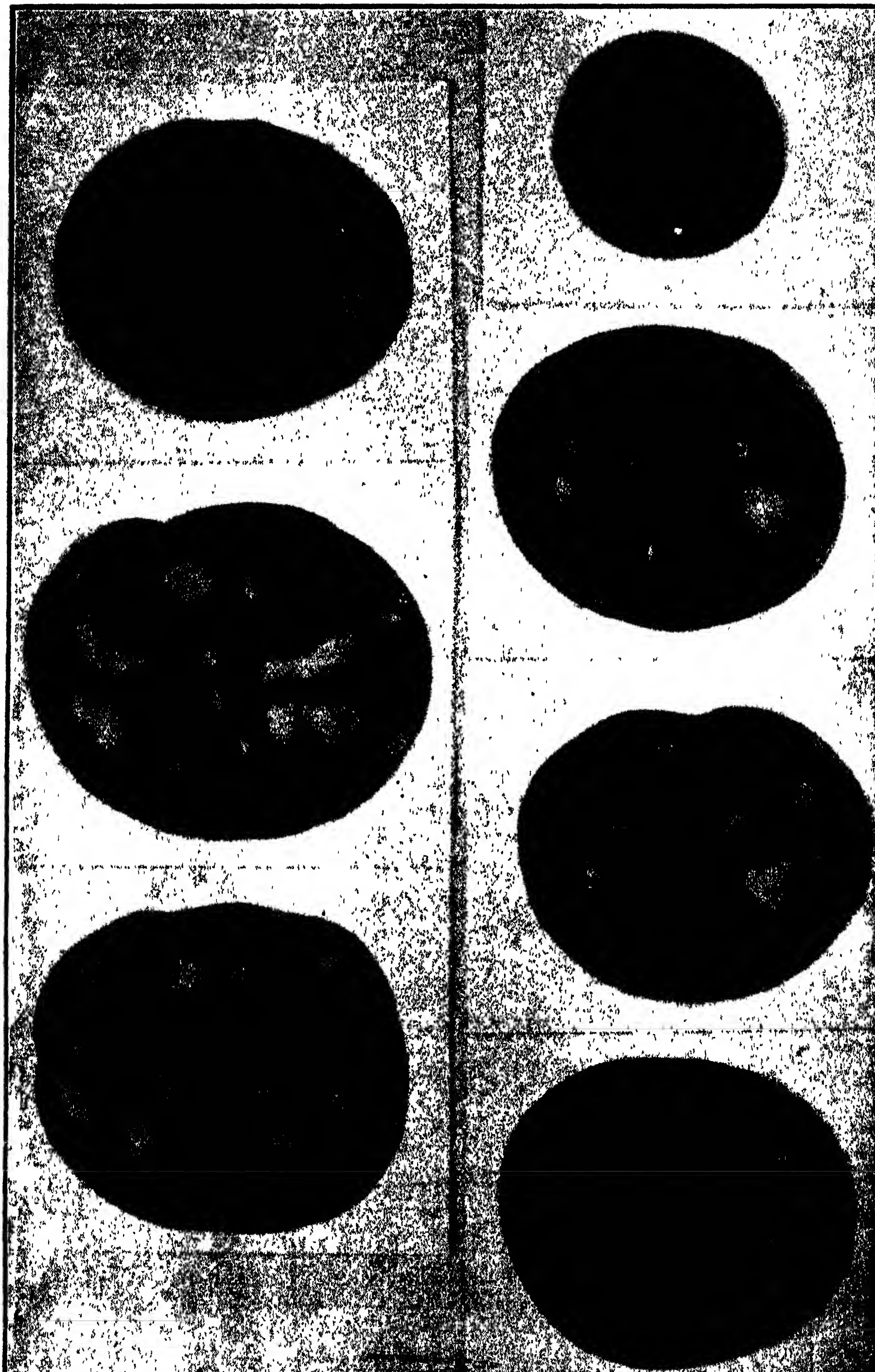

FIG. 5.

Left: Earliana (top), Earliana × Early Long Keeper, Early Long Keeper.
Right: Abundance (top), Abundance × Kondine, Kondine × Abundance, Kondine.

In both hybrids earliness and total yield were improved when compared with the parents. The fruit was of good quality, and in appearance exhibited a close resemblance to the maternal parent. Fruit-size, medium to large.

*Table 10.—Kondine × Early Long Keeper.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Kondine .. .. .. | 1·47 | 5·18 | 1·86 | 8·51 |
| Early Long Keeper × Kondine .. | 3·25 | 4·62 | 3·34 | 11·21 |
| Early Long Keeper .. .. | 4·95 | 4·01 | 2·09 | 11·05 |

The maturity of the hybrid was intermediate between the parents and the total yield similar to Early Long Keeper. However, the hybrid was significantly better than Kondine in these respects. The fruit was of good quality, though medium to small in size. The reciprocal was not available.

*Table 11.—Early Long Keeper × Market Favourite.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Early Long Keeper .. .. | 4·95 | 4·01 | 2·09 | 11·05 |
| Early Long Keeper × Market Favourite | 1·47 | 5·25 | 5·25 | 11·97 |
| Market Favourite .. .. | 3·61 | 3·40 | 1·66 | 8·67 |

Early Long Keeper and Market Favourite were rather similar in type, though the former was somewhat the better of the two. The hybrid gave a slight increase in total yield, but was the only case where maturity of a hybrid was later than either parent. This was probably due to the similarity in parental type. The fruit was of fair quality, and medium in size.

*Table 12.—Market Favourite × Marglobe.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Market Favourite .. .. | 3·61 | 3·40 | 1·66 | 8·67 |
| Market Favourite × Marglobe .. | 2·31 | 5·06 | 4·22 | 11·59 |
| Marglobe × Market Favourite .. | 3·50 | 7·37 | 4·78 | 15·65 |
| Marglobe .. .. .. | 1·11 | 3·74 | 1·16 | 6·01 |

Here maturity was equal to the earlier parent in one cross, but intermediate in the reciprocal. Both the hybrids gave higher yields than the parents, one being much higher than Market Favourite. The fruit-quality was good, but medium in size.

*Table 13.—Marglobe × Earliana.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Marglobe .. .. .. | 1·11 | 3·74 | 1·16 | 6·01 |
| Marglobe × Earliana .. .. | 4·0 | 7·65 | 2·75 | 14·40 |
| Earliana × Marglobe .. .. | 3·53 | 7·15 | 3·88 | 14·56 |
| Earliana .. .. .. | 2·75 | 2·90 | 2·28 | 7·93 |

Both the hybrids produced greater crops in all three periods, giving a greater increase in total yield. Fruit-quality was generally good, though some tended to split around the top. The fruit was fairly large in size.

*Table 14.—Burwood × Earliana.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Burwood .. .. .. | 0·66 | 2·16 | 1·14 | 3·96 |
| Burwood × Earliana .. .. | 4·72 | 7·15 | 3·16 | 15·03 |
| Earliana .. .. .. | 2·75 | 2·90 | 2·28 | 7·93 |

The hybrid available was much earlier than either parent, with a total yield 89 per cent. above Earliana. The fruit-quality was good, though of medium size.

*Table 15.—Burwood × Abundance.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Burwood .. .. .. | 0·66 | 2·16 | 1·14 | 3·96 |
| Burwood × Abundance.. .. | 2·65 | 9·63 | 5·12 | 17·40 |
| Abundance × Burwood .. | 4·44 | 8·63 | 4·16 | 17·23 |
| Abundance .. .. .. | 0·97 | 6·14 | 6·97 | 14·08 |

In this case there was a marked hastening of maturity on crossing, as well as some increase in yield. However, the fruit was too small for commercial requirements, due to the influence of the Abundance parent.

*Table 16.—Abundance × Market Favourite.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Abundance .. .. .. | 0·97 | 6·14 | 6·97 | 14·08 |
| Abundance × Market Favourite .. | 2·61 | 8·72 | 8·60 | 19·93 |
| Market Favourite .. .. | 3·61 | 3·40 | 1·66 | 8·67 |

The hybrid was intermediate in maturity, though tending towards the earlier parent. The total yield was much greater than either parent. The fruit was good, but small.

*Table 17.—Abundance × Marglobe.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Abundance .. .. .. | 0·97 | 6·14 | 6·97 | 14·08 |
| Abundance × Marglobe.. .. | 3·03 | 7·72 | 5·03 | 15·78 |
| Marglobe .. .. .. | 1·11 | 3·74 | 1·16 | 6·01 |

The hybrid was earlier than either parent, and slightly more productive. The fruit was of good quality, though rather small in size.

*Table 18.—Marglobe × Burwood.*

| — | Yield of Fruit in Pounds (Five Plants). | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | Total. |
| Marglobe .. .. .. | 1·11 | 3·74 | 1·16 | 6·01 |
| Burwood × Marglobe .. .. | 1·03 | 3·34 | 1·63 | 6·00 |
| Burwood .. .. .. | 0·66 | 2·16 | 1·14 | 3·96 |

The hybrid showed no superiority to Marglobe. The fruit was of good quality and medium in size.

## Discussion.

It will be seen from a perusal of the results that practically all the hybrids have given total yields higher than both parents; the superiority was such that the average increase of all the hybrids over the parent varieties was 95 per cent. A majority also gave a decided increase in the yield of fruit picked in the early period.

It would be necessary to use first-generation hybrid seed each year, as the measure of increase obtained in the first-generation hybrids is not expressed to the same extent in later generations. However, tomato-seed retains its viability for a considerable time, so that enough seed could be produced in one season to last for several years. Very little labour is involved in the production of hybrid seed. A few plants of the desired parental types must be grown and cross-fertilized at the appropriate period. A description of the method of hybridization can be found in reference (1). With a little experience, over one hundred flowers can be crossed in one day. Allowing from one to two hundred seeds per fruit, enough seed would be produced to plant 1 to 2 acres.

Each district requires a certain type of tomato for its specific market requirements. It is, therefore, most likely that growers in each district would have to experiment, to some extent at least, with the object of discovering which two varieties, when

crossed one with another, would give, not only a measure of earliness and increased yield in the first-generation hybrid, but also the type of tomato which they require.

ACKNOWLEDGMENTS.

The foregoing experiment and the preparation of this article were accomplished under the direction of Messrs. J. W. Hadfield and R. A. Calder.

LITERATURE CITED.

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# MANGELS.

## SOME CHARACTERISTICS OF VARIETIES GROWN IN NEW ZEALAND.

R. A. CALDER, Agronomy Division, Lincoln.

IN New Zealand an area of approximately 13,000 acres is occupied annually by mangels. The provincial acreages for the 1935–36 season were :—

| | | | |
|---|---|---|---|
| North Auckland | 210 | Marlborough | 121 |
| Auckland | 524 | Westland | 4 |
| Gisborne | 196 | Canterbury | 4,304 |
| Hawke's Bay | 708 | Otago | 2,390 |
| Taranaki | 807 | Southland | 127 |
| Wellington | 3,732 | | |
| Nelson | 87 | Total | 13,210 |

Although the total acreage is not large, the crop is well distributed; it is grown most extensively in Canterbury, Wellington, and Otago. In consideration of the fact that mangels are an excellent winter forage crop it would seem that a further increase is warranted.

Mangels prefer warm conditions and, for highest yields, a fertile soil. When well established they can withstand drought better than other root crops and suffer little handicap on account of disease. Yields of from 50 tons to 60 tons per acre are common over wide areas and the roots afford a palatable, wholesome, succulent forage for winter use.

Practically all the seed used is imported from England. There are numerous varieties which vary in behaviour as well as in appearance—*e.g.*, the long or semi-long types thrive best on soils which are rich and fertile, whereas for poorer conditions it is preferable to grow the intermediates, tankards, or globes.

In order to obtain some information concerning the characteristics of the different types, an investigation was commenced in the 1934–35 season. Distinct lines of different varieties were obtained from seed-merchants and grown at Palmerston North.

In comparing the different lines and in contrasting the different varieties, type observations were recorded, approximate yields were obtained, and sugar and dry-matter contents were determined.

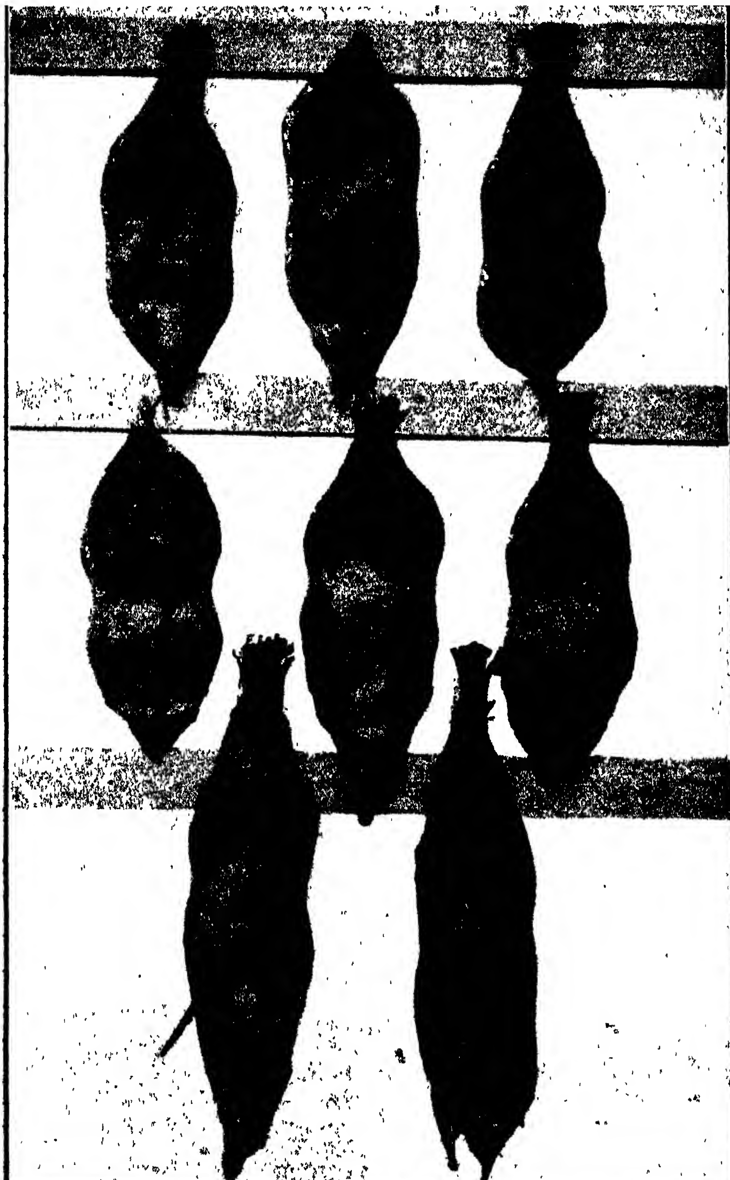


FIG. 1. TOP, GOLDEN TANKARD; MIDDLE, RED INTERMEDIATE; BOTTOM, LONG RED.

NOTE.—Root-size cannot be compared in the separate photographs.

## TYPES OF MANGELS.

Mangel varieties may be grouped according to their shape, and the most convenient expression of this character is a length to breadth ratio. Table I shows a classification based on such determinations, and includes observations on skin and flesh colour.

*Table I.—Classification of Varieties according to Shape, with a Description of Skin and Flesh-colour.*

| Class and Variety. | Skin-colour. | Flesh-colour. |
|---|---|---|
| Long (length/breadth, ratio 4 : 1)— | | |
| Long Red (Fig. 1) .. | Bright red below ; duller red above | White, with uneven red bands or rings. |
| Semi-long (length/breadth, ratio 3·5 : 1)— | | |
| Sugar 1 (Fig. 2) .. | Pale red or pink below ; dull pinkish-green above | Dominant white with darker bands ; a few with pink bands. |
| Sugar 2 .. .. | White below ; drab green above | White. |
| Jersey Queen (Fig. 2) .. | Yellow or pale orange below ; bronze-green above | White, with darker bands. |
| Gatepost (Fig. 2) .. | Pale yellow below ; bronze-green above | White with, occasionally, greenish-yellow bands. |
| Dairyman (Fig. 2) .. | Pale yellow to light orange below ; pale bronze-green above | White, with darker bands, which are occasionally a very pale green |
| Intermediate (length/breadth, ratio 2·5 : 1)— | | |
| Red Intermediate (Fig. 1) | Bright red below ; dull reddish-green above | White, with occasional uneven red bands |
| Tankard (length/breadth, ratio 2·5 : 1)— | | |
| Golden Tankard (Fig. 1) | Bright orange below ; drab, pale greenish-brown above | Whitish cream to yellow, with dark-yellow bands. |
| Semi-globe (length/breadth, ratio 2 : 1)— | | |
| White Knight (Fig. 5) .. | Greenish or pale yellow below ; drab, bronze-green above | White. |
| Globe (length/breadth, ratio 1·5 : 1)— | | |
| Prizewinner (Fig. 3) .. | Yellow or yellow-brown below; bronze-green above | White, with faintly darker bands. |
| Yellow Globe (Fig. 3) .. | Yellow or yellow-brown below ; bronze-green above | White, with, occasionally, uneven yellow bands. |
| Orange Globe 1 (Fig. 4) | Dark orange below ; drab, light-brown above | Pale yellow, with dark-yellow or yellow-brown bands. |
| Orange Globe 2 (Fig. 4) | Medium to dark orange below ; drab, green-brown above | White, with darker bands occasionally tinged yellow. |
| Orange Globe 3 (Fig. 4) | Pale orange to yellow below ; drab, bronze-green above | Mainly white, with darker bands ; a few with yellowish bands. |
| Golden Standwell (Fig. 5) | Bright orange below ; drab, pale greenish-brown above | Whitish cream to yellow, with dark-yellow bands. |
| Lemon Globe (Fig. 3) .. | Cream or pale yellow below ; bronze-green above | White, with darker bands. |
| Quite Content (Fig. 5) | Pale pink to light red below ; greenish-pink above | White, with darker bands. |

Two distinct types were received under the varietal name of "Sugar" mangel, and three under the name of "Orange Globe." The differences in each case, however, were not outside the limits of variation that might be expected to arise as a result of several firms selecting the same variety along individual lines. "Dairyman" and "Jersey Queen" proved to be very much alike, while "Prizewinner" and "Yellow Globe" appeared identical.

A characteristic of "Red Intermediate" and to a lesser extent of "Golden Tankard" was the incurving of the root at the middle resulting in a definite waist.

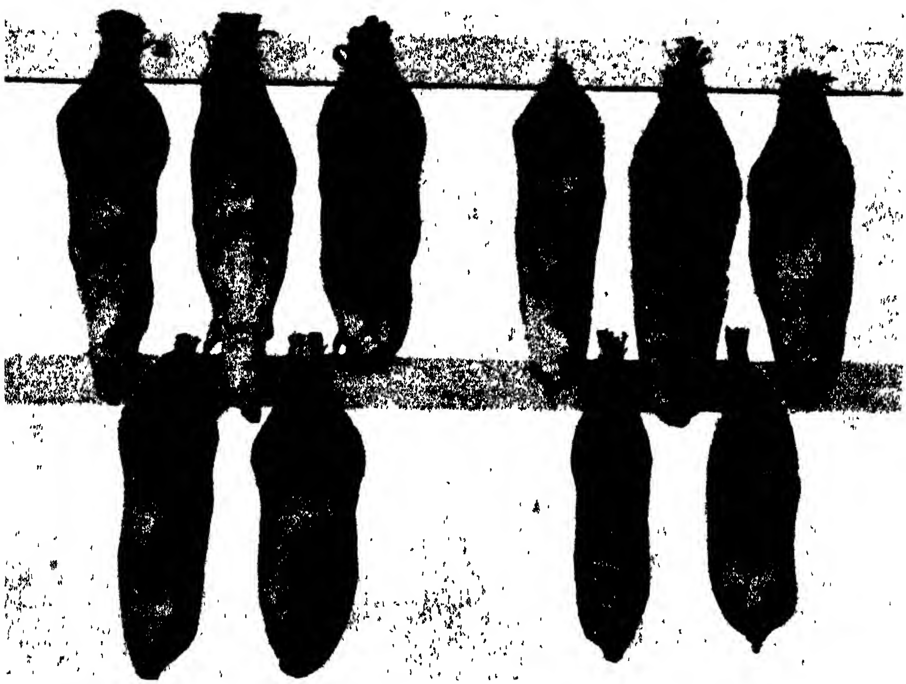


FIG. 2. TOP LEFT, RED SUGAR; TOP RIGHT, JERSEY QUEEN; BOTTOM LEFT, DAIRYMAN; BOTTOM RIGHT, GATEPOST.

## Varietal Purity.

For most varieties there are a number of strains available. These, generally, are indistinguishable, though occasionally some are less satisfactory than others; they may be of a poorer type or contain a higher percentage of rogues. Occasionally also they become incorrectly named. One of the purposes of the trial was to investigate this position.

The general standard of purity proved to be reasonably satisfactory. Four lines out of 45, or about 9 per cent., were incorrectly named, but the percentage of foreign varieties and off types within each line amounted to only about 1 per cent. Therefore, while the nomenclature of varieties may be a little at fault, the standard of purity is high. Observations were made on the incidence of disease; very little was in evidence.

Records taken may be observed in Table II.

Table II indicates the number of lines of the different varieties which were received, the number incorrectly named, the degree of type purity, and the incidence of disease.

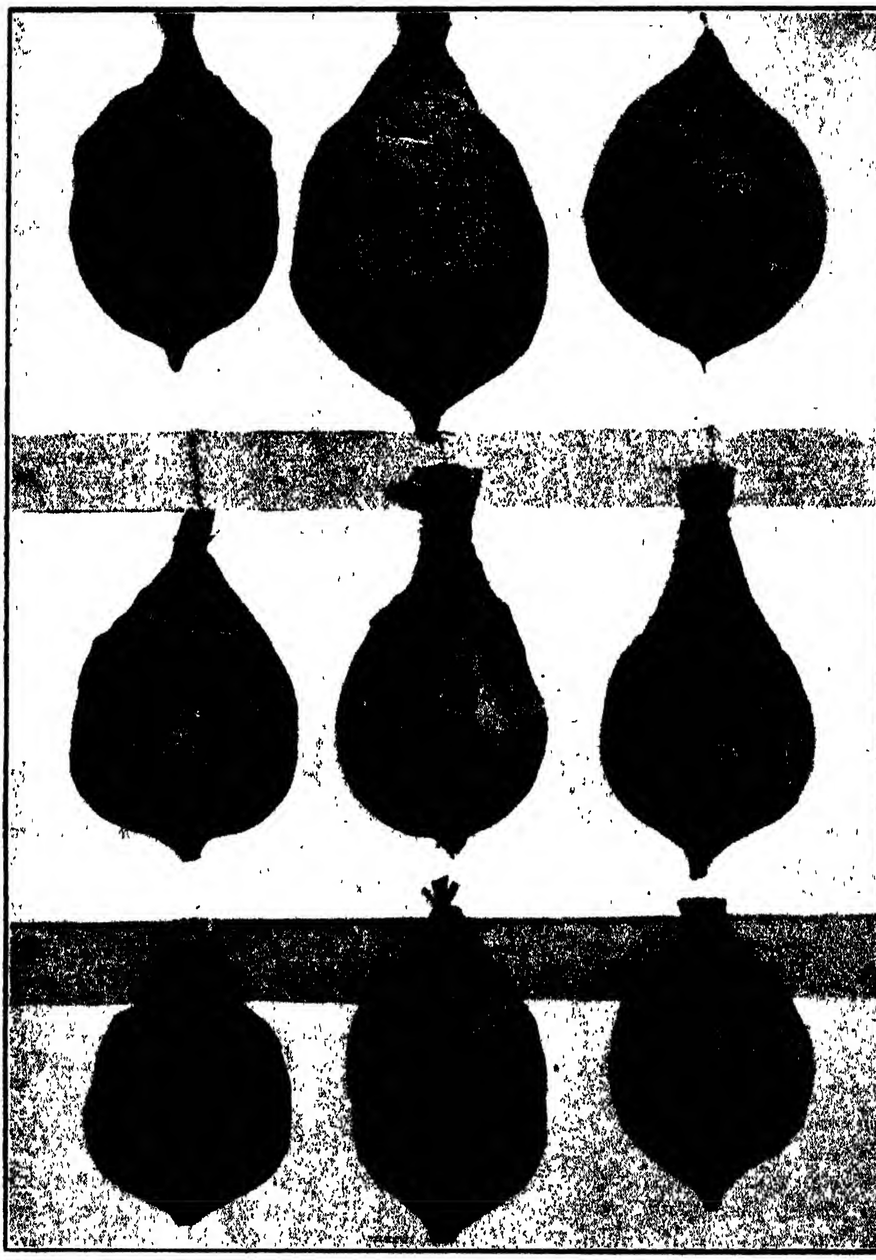


FIG. 3. TOP, YELLOW GLOBE; MIDDLE, PRIZEWINNER; BOTTOM, LEMON GLOBE.

*Table II.*

| Variety. | Number of Lines sent in. | Number of Lines incorrectly named. | Average Per Cent. of Rogues and off Types. | Average Per Cent. of Diseased Roots. | Remarks. |
|---|---|---|---|---|---|
| Long Red .. | 5 | .. | 0·4 | 0·8 | |
| Sugar (red) .. | 3 | .. | 0·7 | 1·4 | Red Sugar mangel. |
| Sugar (white) .. | 1 | .. | 0·5 | .. | White Sugar mangel. |
| Jersey Queen .. | 5 | 2 | 1·4 | .. | One line judged to be Golden Tankard; one line judged to be Yellow Globe. |
| Gatepost .. | 2 | 1 | 5·5 | .. | One line judged to be Long Red. |
| Dairyman .. | 1 | .. | .. | .. | Rather similar to Jersey Queen. |
| Red Intermediate | 5 | .. | 0·4 | .. | One line named Red Lion |
| Golden Tankard | 4 | .. | .. | 1·1 | |
| White Knight .. | 2 | 1 | 2·8 | .. | One line judged to be Golden Tankard. |
| Prizewinner .. | 5 | .. | 0·4 | 0·4 | Similar to Yellow Globe. |
| Yellow Globe .. | 5 | .. | .. | 0·4 | |
| Orange Globe 1 .. | 1 | .. | .. | .. | Probably Golden Globe |
| Orange Globe 2 .. | 1 | .. | .. | .. | |
| Orange Globe 3 .. | 2 | .. | 1·1 | .. | |
| Golden Standwell | 1 | .. | .. | .. | |
| Lemon Globe .. | 1 | .. | 2·3 | .. | |
| Quite Content .. | 1 | .. | .. | .. | |
| Total .. | 45 | 4 | .. | .. | |

## Yield and Chemical Analyses.

The feeding-value of mangels depends upon their dry-matter content, of which sugar is the most important constituent. Varietal differences exist in regard both to yield and to composition, but as these qualities are influenced by environmental factors it is difficult to obtain representative averages.

An attempt was made, nevertheless, to determine the comparative values of a few varieties, based on yielding-ability and on dry-matter and sugar content. The results are offered in Table III, but as they have been obtained from an insufficient number of trials no strict reliance can be placed upon them.

*Table III.—Yields and Analyses of Mangel Varieties.*

| Variety. | A. Yields, in Tons per Acre, 1934–35. | B. Yields in Tons per Acre, 1935–36. | Average of A and B. | Dry-matter Per Cent., 1935–36. | Dry-matter Yield, Tons Per Acre, 1935–36. | Sugar, Per Cent., 1935–36. | Sugar Yield, Tons Per Acre, 1935–36. | Average Weight of a Single Root, in Grams, 1935–36 |
|---|---|---|---|---|---|---|---|---|
| Long Red .. .. | 64·1 | 47·0 | 55·6 | 9·7 | 4·56 | 6·3 | 2·96 | 2,214 |
| Sugar 1 (red) .. | 68·1 | 37·5 | 52·8 | 13·2 | 4·95 | 8·0 | 3·00 | 1,941 |
| Sugar 2 (green) .. | 74·5 | 50·0 | 62·3 | 9·5 | 4·75 | 5·4 | 2·70 | 2,434 |
| Jersey Queen .. | 72·2 | 51·0 | 61·6 | 8·9 | 4·54 | 5·1 | 2·60 | 2,431 |
| Red Intermediate .. | 74·0 | 58·0 | 66·0 | 8·2 | 4·76 | 5·0 | 2·90 | 2,839 |
| Golden Tankard .. | 65·0 | 36·0 | 50·5 | 9·8 | 3·53 | 5·6 | 2·01 | 2,084 |
| White Knight .. | 75·7 | 55·5 | 65·6 | 8·4 | 4·66 | 4·9 | 2·72 | 3,324 |
| Yellow Globe .. | 68·8 | 60·0 | 64·4 | 8·1 | 4·86 | 5·3 | 3·18 | 2,741 |
| Orange Globe (3) .. | 73·3 | 72·0 | 72·6 | 7·2 | 5·18 | 4·1 | 2·95 | 2,931 |
| Lemon Globe .. | 84·7 | 66·5 | 75·6 | 7·7 | 5·12 | 4·2 | 2·79 | 3,437 |

*Comments on Table III.*

1. Yields in the 1934–35 season were obtained from plots grown at the Plant Research Area, Palmerston North. In the 1935–36

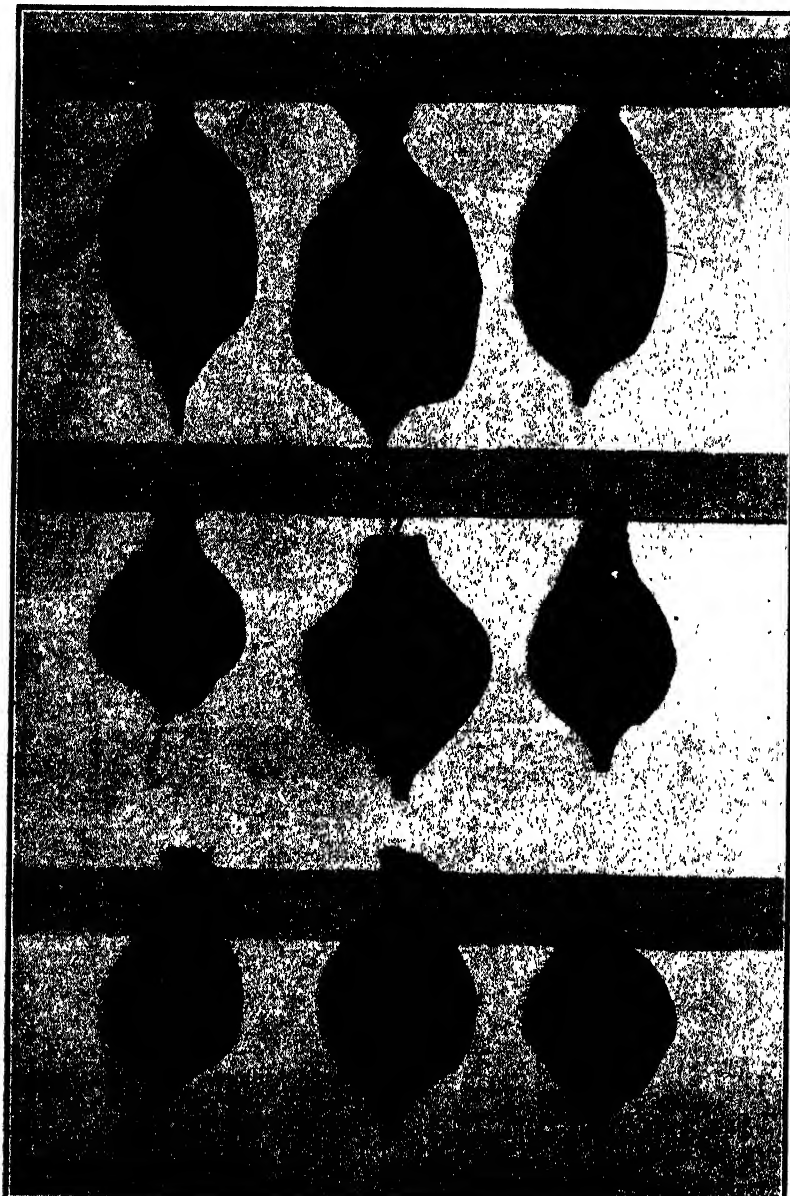


FIG. 4. TOP, ORANGE GLOBE 1; MIDDLE, ORANGE GLOBE 2; BOTTOM, ORANGE GLOBE 3.

season the trial was repeated at Massey College, and representative samples were forwarded to the Dominion Analyst, Wellington, for analysis.

2. With some exceptions, the following relationships between certain characteristics are indicated :—

(*a*) *Shape and Yield.*—The longer-shaped varieties tend to produce lower yields than the globe-shaped types.

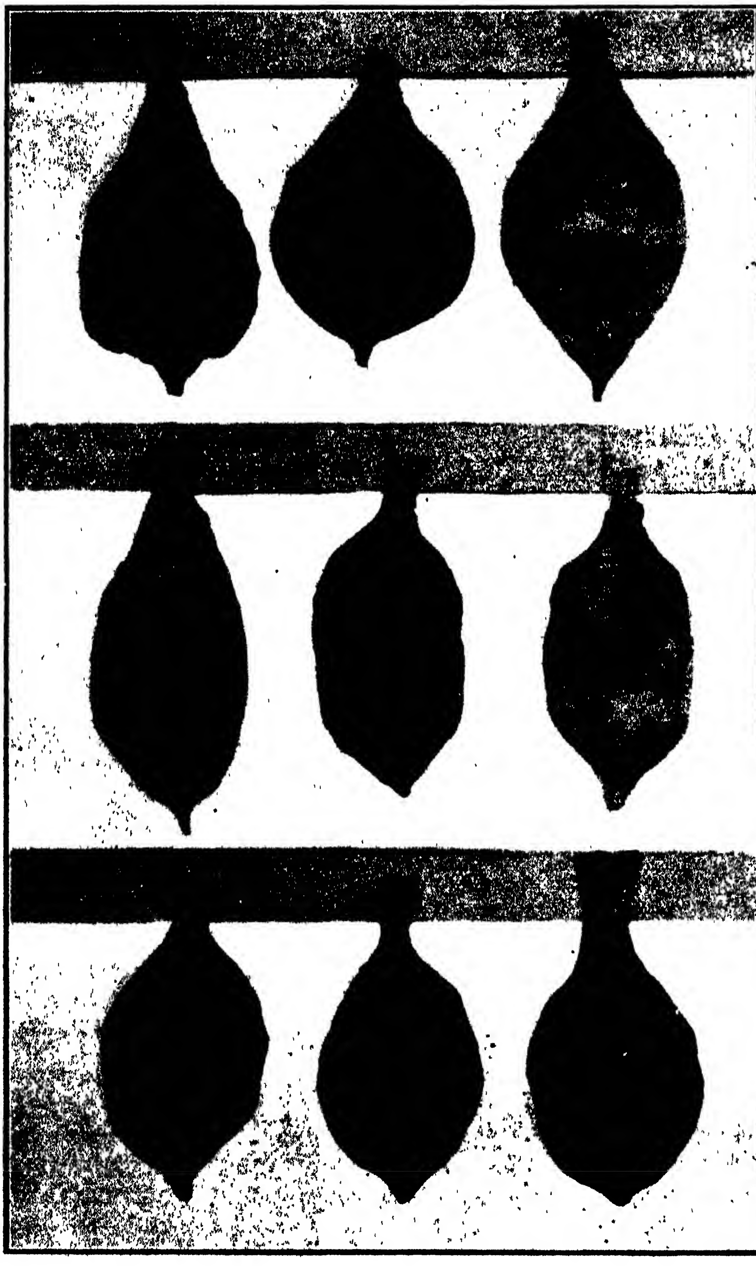


FIG. 5. TOP, QUITE CONTENT ; MIDDLE, WHITE KNIGHT ; BOTTOM, GOLDEN STANDWELL.

(*b*) *Yield and Quality.*—Types giving the heaviest yields are poorer in dry-matter and sugar content than those giving lower yields.

(*c*) *Size and Yield.*—The heaviest yields were obtained from those varieties with the largest individual roots.

(*d*) *Size and Quality.*—The larger roots tend to be poorer in dry-matter and sugar content than the smaller ones. The extra quality possessed by the Red Sugar mangel has in all probability been inherited from its sugar-beet parent.

3. If the yield per acre of dry matter or sugar can be regarded as a measure of the value of a variety then, with the exception of Golden Tankard, there is little to choose between any of those tested; in all probability none of the differences would be significant.

From these results it might be concluded that, from a theoretical point of view, there is little difference in the ultimate feeding-value of any of the varieties considered, Golden Tankard excepted. When viewed practically, though, distinctions can be made for, within certain limits, a variety providing a heavy crop of poor quality would not be such an efficient feeding unit as one giving a lower yield but of better quality.

In connection with these results, the observations of Professor Boving, University of British Colombia, Vancouver, Canada, are of interest. He states: "In no case during thirty years of comparative tests has the Long Red mangel been able to compare in total yield or in feeding value with good varieties of the intermediate or ovoid types. The probable reason why, nevertheless, it has survived in practice is that it was the first mangel to be listed in a seedsman's catalogue." He mentions that the Globes are poorer in dry matter than the intermediates, and continues, "but they (the Globes) may be recommended, nevertheless, where mangels are grown entirely as a conditioner and where the feeding value is of less importance than succulence. Cylindrical mangels are reasonably good total yielders, but they are low in production of dry matter per acre. The Red Sugar mangel cannot compete with the intermediate or ovoid in yield, but, as it is a very good keeper, and, as the composition of its dry matter has a particularly good effect in pig and poultry feeding, it is well worth growing on a limited scale."

These conclusions are not so widely different from those offered above, with the exception that, from the Palmerston North results, the Long Red mangel could not be so severely condemned.

## Loss in Weight during Pitting.

Mangels are generally pitted for some months before feeding. During this period changes take place in the chemical composition of the roots and there is a decrease in weight due, mainly, to the loss of moisture.

Twenty representative roots of the more commonly grown varieties were weighed on pulling and pitted under straw; care was taken to subject each variety to the same conditions. At the end of three months they were again weighed.

The loss of weight during the period of storage is recorded in Table IV. It will be seen that the average loss is about 14 per cent., with a range from 11 per cent. to 17·4 per cent. according to variety.

Loss of weight during pitting must, however, vary considerably according to the method adopted, and the relative loss of an individual root will depend upon the position it occupies in the pit.

Such a trial as this would have to be repeated for several seasons and under varying conditions of pitting before a reliable average could be indicated.

Table IV shows loss of weight, during storage, for some of the more important commercial varieties.

*Table IV.*

| Variety. | Weight, in Pounds, of Twenty Roots prior to Pitting, 23rd June, 1936. | Weight, in Pounds, of same Twenty Roots after Pitting, 2nd September, 1936. | Actual Loss, in Pounds. | Percentage Loss. |
|---|---|---|---|---|
| Long Red .. .. | 126·0 | 107·0 | 19·0 | 15·1 |
| Sugar 1 .. .. | 111·4 | 92·0 | 19·4 | 17·4 |
| Sugar 2 .. .. | 125·2 | 109·5 | 15·7 | 12·5 |
| Jersey Queen .. .. | 128·3 | 112·4 | 15·9 | 12·4 |
| Red Intermediate .. | 137·4 | 120·0 | 17·4 | 12·7 |
| Golden Tankard .. | 111·2 | 93·5 | 17·7 | 15·9 |
| White Knight .. .. | 168·2 | 146·2 | 22·0 | 13·1 |
| Yellow Globe .. .. | 151·0 | 128·8 | 22·2 | 14·7 |
| Orange Globe .. .. | 169·5 | 150·8 | 18·7 | 11·0 |
| Lemon Globe .. .. | 153·5 | 133·2 | 20·3 | 13·2 |

## SUMMARY.

1. The mangel varieties commonly grown in New Zealand have been grouped according to shape; skin and flesh colour has been described.

2. A number of lines of each of the varieties were received. These were examined to determine the percentage incorrectly named, the degree of type purity and the incidence of disease.

3. An attempt was made to evaluate the varieties based on total yield and on dry-matter and sugar content.

4. Approximate figures for the loss of weight during storage were obtained.

## ACKNOWLEDGMENTS.

This work was supervised by Mr. J. W. Hadfield, Director, Agronomy Division. The yield trials at Massey College were carried out under the direction of the ex Dairy-farm Manager, Mr. S. McGuiness, the analyses were determined by the Dominion Analyst, Wellington, and the photographs were taken by Mr. H. Drake.

# SEASONAL NOTES.

## THE FARM.

### Special Measures regarding Winter Feed.

An outstanding feature of the present farming position throughout most of New Zealand is the prospective abnormally large shortage in reserves of feed for use in the winter and early spring of next year. The normal provision of feed for this critical period is substantially less than sufficient to meet the economic needs of stock—a fact which often is well demonstrated when comparisons are made between the returns of farms of an average standard of winter feeding and those of farms on which the winter feeding is appreciably better than the average. As the provision of reserves for the coming winter promises to be poorer than the normal one, which is harmfully scant, an acute position is likely to arise unless all possible remedial steps are taken. Frequently in January there is still time to make additional provision.

If favourable weather is experienced in time to allow of the preparatory cultivation which is advisable, a valuable measure is the sowing of temporary pasture, in the late summer or early autumn, on ground which, if not already broken out of grass would soon be so. A temporary mixture generally useful is to be expected from the sowing of 25 lb. to 30 lb. of Italian rye-grass and 6 lb. of red clover an acre. To ensure that temporary pastures provide a substantial amount of winter feed they must be sown early, and they generally can be depended upon for a heavy crop of hay in the next summer. If the temporary pasture is likely to have a life of less than a year and quick production of feed is especially desirable, then half of the Italian rye-grass may be replaced usefully by an equal amount of seed of Western Wolths rye-grass.

When the land to be used for late summer or autumn sowing is to be sown in spring in another crop it is likely to prove advisable to grow a fall-sown green-cereal catch-crop such as oats or barley, both of which usually give good results when sown at the rate of about 2½ bushels an acre. Such catch-crops, which under favourable circumstances give considerable feed in winter and early spring, may be followed by root or other suitable crops in the spring. Catch-crops after turnips or another cereal crop at times give quite good results when sown after relatively a very small amount of preparatory cultivation. Disking at times gives sufficient tilth for the seed-bed required. With such crops a dressing of superphosphate usually is profitable ; as a rule 1 cwt. an acre may advantageously be used in districts of somewhat low rainfall, while 2 cwt. an acre may be well worth while in districts of good rainfall, if the response to phosphates is known to be high, and it frequently is. Such dressings of superphosphate as a rule increase not only the yield but also the rate of growth.

Often the fullest possible yields are not obtained from temporary pastures or cereals sown for winter feed because the crops are sown too late. This applies particularly in the South Island. Further, the likelihood of success with such crops is lessened if there has not been thorough preparatory cultivation. To give the mellow condition of the soil that results from aeration and weathering, if possible a month should elapse between the initial preparatory cultivation and the sowing. Against this is to be set the fact that the date of sowing is a critical matter ; crops sown in January or February as a rule are much better for winter feed than ones sown in March, while crops sown in March may be expected to be appreciably superior to ones sown later.

Conclusive information about the varieties of cereals commonly used for green-feed purposes seems not to be available, but the following facts yield some guidance: Algerian oats, on the basis of field experience, has for many years continued decidedly popular; black skinless barley excels in the quick production of green-feed, but is likely to be otherwise inferior to Algerian oats. Cape barley also is marked by quick production of green-feed, but its tendency to become stemmy in late winter and early spring is a definite weakness in respect to the production of green-feed at that period.

### General Cropping Work.

When the sowing of turnips and swedes has not been completed by the end of December, as a rule it should be carried out as speedily as possible. In most places after the middle of January it is better to sow turnips than swedes: turnips not only develop more quickly than swedes, but also suffer less from insect pests, which at times, and particularly in dry seasons, cause severe damage in late summer and autumn. Hardy Green Globe turnips are suitable for January sowing. Both turnips and swedes usually respond quite profitably to a dressing of fertilizer in which superphosphate is prominent.

Although generally the sowing of lucerne in November or December is preferable, it sometimes may be carried out with good results after mid-summer, but this, judging from field experience, is true only of districts in which the winter growth of plants in general is small In districts characterized by mild winters, fall sowing of lucerne generally though not quite always has given unsatisfactory results; in such districts the cold of winter suffices to make lucerne dormant, but plants invading the lucerne, including rye-grass and common weeds, make enough growth through the winter to outgrow the lucerne-seedlings sufficiently to deprive them of the direct sunlight which is vital to them and without which they cannot compete successfully with the invading plants. If it is expected that there will be sufficient soil-moisture to allow of superphosphate exerting its fertilizing influence, then it is usually good practice to top-dress established lucerne about mid-summer with superphosphate just after it has been mown.

As a rule potatoes call for considerable work at this season. They should be kept free from weeds by suitable cultivation; possibly they should be sprayed preferably at such a date that the spraying will serve to prevent the establishment of blight in the crop rather than to check the spread of blight that has become established. Nevertheless, this latter benefit is often a very useful result of spraying which is likely to be not only more effective but also cheaper when the spraying-material used has been prepared suitably on the farm instead of purchased in a ready-made form. It is important to bear in mind that incorrect procedure in any particular may lead either to damage to the crop or to failure to control the blight. Full particulars about the preparation and application of sprays may be obtained from district officers of the Fields Division. At this season many potato crops will need to be moulded up. In districts in which the crops are likely to be subject to attacks of the potato-moth, moulding-up should be carried out with particular thoroughness as well-covered tubers are likely to escape damage by the moths.

As a rule the thinning of such crops as mangels and carrots should be carried out at this season—the Guerande carrot, because of its habit of growth normally does not need thinning. Any considerable delay in carrying out the thinning after the seedlings have become large enough to handle conveniently may bring about readily the permanent stunting of the plants.

In any year in which the supply of moisture in the soil is below what is needed to enable crops to make the greatest possible amount of growth, the summer tillage of crops which permit of it—*e.g.*, potatoes, mangels, &c.—is of paramount importance. A common cause of yields of crops being

greatly below the yields that otherwise would be obtained is an inadequate supply of moisture in the soil in summer. Surface tillage is of marked value as a means of checking loss of soil-moisture. Further, suitable tillage brings about aeration which leads to improved fertility. To farmers in general a splendid object-lesson in the value of summer tillage commonly is given by Asiatic market-gardeners in the Dominion, who so often may be seen diligently tilling their crops in summer even though weeds are not in evidence—a procedure which even in arid districts or seasons regularly gives them good crops.

### Preparation for New Pastures.

One of the tasks of basic importance to be faced by many farmers during the next few months is the sowing of new pastures, which often clearly does not receive as much thought as it warrants. A vital aspect of the position is that many persevere with inferior pastures when the most profitable course would be to put such poorly productive grassland under cultivation with the ultimate objective of resowing to obtain a new, superior pasture in the establishment of which it would be possible to use the superior strains of rye-grass, clover, &c., which have been introduced to commerce during fairly recent years, and which enable high-class pastures of a permanent character to be obtained.

Really poor results in the establishment of pastures are far from uncommon. It is of much practical importance to bear in mind at this season that such poor results are generally due to one or more of the following causes: (1) Sowing on a poorly prepared seed-bed; (2) sowing at an unsuitable time of the year; (3) use of unsuitable seed. In the case of pastures sown in the fall of the year both sowing on a poorly prepared seed-bed and sowing at an unsuitable time of the year usually may be traced to starting preparatory cultivation at too late a date. Full success in the sowing of permanent pastures may be expected only when the seed-bed is in a fine firm condition: the use of loose lumpy seed-beds is certainly courting failure, which though it is unlikely to be complete, is very likely to be particularly costly in its influence on the returns over a series of years. For instance, loose lumpy seed-beds quite often are linked with failures of clovers, a poor development of which is not consistent with a vigorous highly nutritious and highly palatable pasture. To secure a desirable seed-bed the cultivation of land to be sown in permanent pasture in the fall now should be kept in mind. A short preparation of the seed-bed does not allow of the natural weathering of the soil which field practice has shown to play a valuable role in the economical production of a fine, firm seed-bed. If preparatory cultivation is not commenced early enough, a ready alternative to sowing on a poorly prepared seed-bed at the right time is sowing later on a well-prepared seed-bed. Fairly often the date of sowing of pastures in the autumn is too late. In many parts some danger attaches to sowing later than March Undoubtedly sowings made later than March at times are quite successful, but in many districts in the majority of seasons such late sowings cannot be depended upon for good results. It seems to be widely known that clovers are likely to suffer in late sowings, but it probably is not so generally realized that the development of rye-grass and other plants is at times subject to such great checks as the result of late sowings that it becomes doubtful whether the new pasture ever attains the level of production that a suitably early sowing would give: apart from any damage by the clovers slow development of pasture-seedlings may readily give weeds a greater foothold than they could gain during the quicker development that early sowing with its greater soil-warmth brings about.

If pasture is to follow an arable crop it may quite well be sound practice, provided the land is reasonably clean, to disk rather than to plough: the firmness of the seed-bed given by the disking may be an advantage, and in disking any fertilizing-matter provided by animal manure is kept near

the surface where it is of most ready and effective benefit to the young pasture-plants. The value of firmness in the seed-beds for pastures is often demonstrated in the form of unusually good "strikes" where there has been exceptional consolidation—*e.g.*, in hoof-marks or in wheel-tracks or along headlands. Apart from the fact that firmness in the seed-bed seems to lead to vigorous root-development in pasture-plants, it is of major importance that there is less likelihood of seeds being covered too deeply in firm seed-beds: many of the pasture-seeds are so small that they can establish successfully only when lightly covered.

**Top-dressing of Mown Grassland.**

In those many districts which enjoy reasonably good summer rains and which have soils that ordinarily respond profitably to phosphates, an immediate and marked benefit may be expected from top-dressing with superphosphate any pastures from which hay or silage has been saved this year, unless such pastures recently have been top-dressed fairly liberally: it is usually preferable to apply the superphosphate as soon as the mown material has been removed. When pastures were mown at a leafy stage of development more vigorous aftermaths may be expected than from similar pastures mown at a later somewhat stemmy stage. But the aftermath while valuable as a source of leafy feed when such feed is likely to be in inadequate supply, especially on dairy-farms, is not always the sole immediate benefit of top-dressing in the way described pastures mown at an over-mature stage may be somewhat weakened, and so may benefit greatly from the strengthening influence of the top-dressing.

**Utilization of Special Summer Feed.**

In dairying, any feed specially grown to supplement the pastures in summer should be fed as soon as the production of butterfat commences to drop at a rate greater than production drops in well-fed cows of reasonably good dairy character. When the yield of a herd is falling off at such a rate that the decrease in production in a month is about 9 per cent. of the yield of the previous month, then the rate of the decline in production may be looked upon as approximately normal—*e.g.*, a herd averaging 30 lb. of butterfat in a particular month may be expected to average 27·3 lb. in the following month if it is of satisfactory dairy type and efficiently fed.

As far as practicable young stock, such as calves, should receive feed supplying liberal amounts of the substances required for the formation of bone and muscular as distinct from fatty tissue. Stemmy pastures are deficient in such substances, and if young growing stock are forced to subsist mainly on feed from such pastures permanent stunting of the stock may result.

*R. P. Connell, Land Utilization Officer*

# THE ORCHARD.

**Cultivation and Cover Crops.**

As the harvesting-season approaches growers may be considering easing up in the cultivation of the orchard. This may be advisable from some points of view, but before it is applied the soil should be brought to a good tilth. Even then a few strokes with the harrows, especially after summer showers, will prove beneficial, as this will help to retain the moisture already conserved in the soil. All trees in the orchard should be thoroughly hoed round, as this will destroy many of the breeding-places for pests and diseases. If the soil is left in good condition before cultivation ceases, the preparation of the land for the sowing of a green-crop early in January will be simplified. Blue lupin has been, and probably still is, the most favoured green-crop

for the orchard, although some growers, under the impression that their soil is "lupin-sick" after a few years of this crop, are reverting to oats and vetches, which is another good green-crop for the orchard. Climatic conditions in different districts have a bearing on the appropriate time for sowing a green-crop; but, if lupins are decided on, early January will generally be found the most suitable time for sowing. This will give plenty of time for the plants to grow and mature before ploughing under in the late autumn or early winter. Green-cropping is strongly advised where the soil is deficient in humus. Not only does a well-grown crop of lupins supply a large quantity of humus to the soil, but it is a means of adding nitrogen, so valuable in maintaining the general health of the tree. An application of superphosphate at the rate of from 1 cwt. to 1½ cwt. per acre is recommended when sowing the crop.

### Thinning the Crop.

The natural drop of all varieties of fruit will be finished by the time these notes appear, and growers are reminded that, where only one thinning has been done, it may be necessary to go over the trees again, removing any fruits that are misshapen, diseased, or badly russeted, &c. This will allow the remaining fruits to develop properly, and thus reduce the quantity of small fruit to a minimum. It will also assist in the production of regular crops each year. All clustered fruit should be, in the majority of cases, reduced to two or three, and where heavy crops have set it often pays to reduce the bunches to individual fruits.

### Pest and Disease Control.

The continuation of spraying, as recommended in previous notes in the *Journal*, should be attended to. Up to the present time growers have been favoured with a good spraying-season, and because of this some are apt to relax their efforts, with the result that pests and diseases become established. Reports from different fruit areas of the Dominion indicate that with the dry weather now being experienced red mite is on the increase. All growers are well aware of the great amount of injury that can be done by this pest, and every endeavour should be made to control it before the over-wintering eggs are deposited. By impairing the condition of the foliage, and thus reducing its functioning-powers, this pest can reduce the vitality of the tree to such an extent that the current season's crop will be seriously affected and buds for the following season considerably weakened. Although the regular applications of lime-sulphur should do much to keep this pest in check, if infection becomes serious it will be necessary to apply nicotine-sulphate, 40 per cent., at strength 1–800, either in combination with the sulphur sprays or alone. If used alone, the addition of soft-soap at the rate of 4 lb. per 100 gallons of spray is necessary to act as a spreader and sticker and increase the effectiveness of the spray.

Green aphis has become very troublesome on stone-fruits this season, possibly on account of the dry, warm conditions. Growers are advised to apply nicotine-sulphate (1–800) for its control. Usually one thorough application is sufficient; but it is advisable to give an extra spray six or seven days later in order to catch any of the aphis missed in the first spray. Stone-fruits should also receive regular applications of lime-sulphur at strength 1–180 for the prevention of brown-rot, leaf-rust, &c. The addition of 2 lb. of colloidal sulphur per 100 gallons will be found beneficial. These sprayings should be continued up to three weeks before harvesting the crop.

As the leaf-roller caterpillar is responsible for much damage to both foliage and fruit, especially where the thinning of fruit has not been sufficient to separate the clusters, a close watch should be kept for any signs of this pest, and lead-arsenate spray applied before the caterpillar has an opportunity of rolling the leaf. Once inside the rolled-up leaf it is almost impossible for the spray to reach the caterpillar.

### Handling the Crop.

Early varieties of stone-fruits will be ready for harvesting during the month, and growers should see that everything connected with the handling of the fruit is ready, so that no time will be lost when picking commences. Stone-fruits require handling with the greatest care: they bruise easily, and any skin punctures may result in the entry of brown-rot. Fruit which has to travel any distance should be picked when firm. Proper grading is essential if the best prices are to be obtained. Only fruit of the same size, and the same degree of maturity, should be packed in the case. Pack the fruit carefully into clean cases and make it as attractive to the buyer as possible. Repeat orders are usually the result of quality combined with attractiveness.

The picking and packing of pip-fruits both for export and the local market will soon be under way, and growers will have very little time to spare for other matters. All fruit-cases should be made up and stacked in a convenient place; cases for export should be labelled; corrugated and wrapping paper placed in a handy position for the packers; rubber stamps and stencils should receive attention; in fact, everything done to ensure smooth working all through the harvesting-period. Another reminder is given to growers to thoroughly clean out the packing-shed, destroy old and dirty picking-cases and spray the whole with a solution of bluestone as recommended in the October notes. Reject fruit should not be allowed to lie in and around the packing-shed, but either given to the pigs or destroyed as soon as possible. In the orchard the necessity for care in handling a perishable article should be fully appreciated. Fruit for the local market should be allowed to remain on the trees longer than fruit intended for export to enable it to reach that stage of maturity most acceptable to the buyers.

—*George Stratford, Orchard Instructor, Motueka.*

### Citrus Culture.

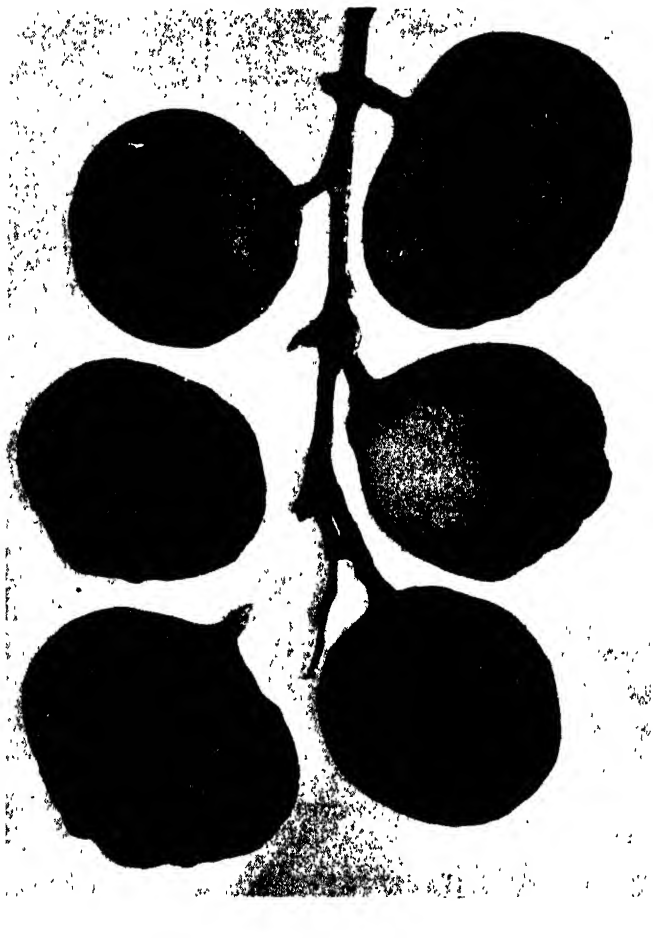
*Citrus Thrips.*—Characteristic symptoms of thrip infection on citrus trees is a silvering of the foliage—particularly the underside—and portions of the fruit. The appearance of injury caused to fruit early in the season changes as the season advances into rough scurfy areas. In cases of severe infection these areas will at times cover the greater portion of the fruit. Such blemishes lower the market value of the fruit appreciably and the injury to the foliage checks the general vigour of the trees. Long periods of low rainfall accompanied by high temperatures when occurring between January and May usually result in the rapid spread of the pest. Mandarin and orange trees are generally affected much more severely than lemon trees.

As mentioned in these notes for the previous month, control measures applied at the blossoming period are of doubtful value. In most seasons thrips cause no great amount of damage until late in January or later, consequently a close watch for infection should be kept at this period. Good control can be obtained by spraying at four-weekly intervals during the late summer and autumn with lime-sulphur (15 per cent. polysulphide content at a dilution of 1–45. It is important that the spraying should be done thoroughly, care being taken to direct the spray towards the underside of the foliage. Orange and mandarin trees in particular should be thinned by pruning where necessary to ensure the spray reaching all portions of the tree.

*New Plantings.*—If a prolonged spell of dry weather is experienced it may be necessary to water trees that were planted in the spring. In such cases sufficient water should be used at each application to allow of penetration to the deepest roots. Frequent light waterings are to be avoided as this practice tends to keep the soil cold and brings the rootlets too near to the soil surface.

Shoots arising from the trunks should be rubbed off as they appear and straggling shoot growth should be pinched back to enable the tree to develop a balanced head. Frequent attention to such matters in young trees often prevents the need for cutting out large limbs in later years.

*Bud Selection.*—Many orange and lemon trees in established orchards are consistently producing fruit of an inferior type, and these should be worked over with as little delay as possible with buds carefully selected from trees



INFERIOR TYPE OF EUREKA LEMON.

Trees producing such fruit should be worked over with buds taken from outstanding trees.

producing the best strain of the varieties to be worked. The Orchard Instructor for the district in which you are located will be pleased to advise you in connection with this matter and where suitable bud-wood may be obtained.

*Insect Pests.*—It is of the utmost importance that red scale (*Chrysomphalus aurantii*) infection should be reduced to an absolute minimum as early as possible. The scale not only causes tree debilitation, but it necessitates the scrubbing of infected fruits, which often results in injury to the skin, and subsequently in a high percentage of mould infection during the curing and marketing period. To ensure a satisfactory control by spraying with summer-oil, as recommended in these notes for the past month, it is essential

that the trees should be sufficiently open to permit of the spray penetrating to every part of the surface of the trees. Trees which are excessively dense in the heads should be thinned by pruning before the spray is applied. Special attention, in spraying for red scale, should be given to the uppermost and lower branches since these portions of the tree are most likely to be missed by the spray.

—*P. Everett, Orchard Instructor, Gisborne.*

## POULTRY-KEEPING.

**Feeding**—*continued.*

In last month's notes a popular method of feeding was given. The following are other rations which the writer has seen fed with success:—

*No. 1.*

| | | |
|---|---|---|
| Pollard | 2 measures | Mixed with water. |
| Bran | 1 measure | |
| Meat-meal | 7½ per cent. | |
| Oyster-shell dust | 1 per cent. | |
| Cod-liver oil | 1 per cent. | |
| Chaffed greens | 20 per cent. | |

A light scratch feed of oats at noon, and wheat at night—about 1½ oz. per bird.

*No. 2.*

| | | |
|---|---|---|
| Pollard | 8 measures | Mixed with water. |
| Bran | 4 measures | |
| Oat pollard | 1 measure | |
| Meat-meal | 7½ to 10 per cent. | |

Green food at noon, and a good feed of wheat at night.

*No. 3.*

| | | |
|---|---|---|
| Bran | 8 measures | The salt was dissolved in the water with which the mash was mixed. |
| Wheat-meal | 4 measures | |
| Meat-meal | 1½ measures | |
| Salt | ½ per cent. | |

Equal parts of wheat, cracked maize, barley, and oats at night; green food after last feed at night.

*No. 4.*

| | | |
|---|---|---|
| Pollard | 2 to 3 measures | Mixed with skim-milk; meat-meal was always before the birds. |
| Bran | 1 measure | |
| Meat-meal | 5 per cent. | |

Green food at noon; grain at night, consisting of 3 measures of wheat and 1 each of barley and cracked maize.

Where birds were kept on the intensive system—that is, they were never out of the houses—the following rations were fed:—

*No. 1.*

| | | |
|---|---|---|
| Bran | 4 measures | Half a measure of skim-milk powder was dissolved in the water with which the mash was mixed. |
| Oat pollard | 1 measure | |
| Wheat-meal | 1 measure | |
| Pea-meal | ¼ measure | |
| Meat-meal | ¾ measure | |

Wheat was fed at night, and chaffed green food given after the wheat.

*No. 2.*

| | | |
|---|---|---|
| Pollard .. | .. 11 measures .. | The whole was mixed with skim-milk and as much given as the birds could clean up in about an hour. |
| Bran .. | .. 4 measures .. | |
| Ground oats | .. 1½ measures .. | |
| Wheat-meal | .. 1½ measures .. | |
| Meat-meal | .. 1 measure .. | |
| Chaffed greens | .. 6 measures .. | |

Wheat was fed at night—about 1½ oz. per bird.

Dry-feed mixtures, which were fed in hoppers and left before the birds for most of the day, were as follows :—

*No. 1.*

| | | | |
|---|---|---|---|
| Pollard .. | .. 100 lb. | Linseed-meal .. | 3 lb. |
| Bran .. | .. 30 lb. | Wheat-meal .. | 15 lb. |
| Meat-meal | .. 15 lb. | Salt .. .. | 1 lb. |

First thing in the morning the birds were given 1½ oz. each of wheat, and the same amount was given at night ; green food at noon.

*No. 2.*

| | | | |
|---|---|---|---|
| Maize-meal | .. 50 lb. | Skim-milk powder.. | 4 lb. |
| Bran .. | .. 16 lb. | Bone-flour .. | 2 lb. |
| Pollard .. | .. 16 lb. | Linseed-meal .. | 4 lb. |
| Meat-meal | .. 4 lb. | Salt .. .. | ½ lb. |

A light scratch feed of oats at noon ; wheat at night, and green food after the evening meal.

At one of our egg-laying tests where good results have been obtained the following is the system of feeding : A mash is fed in the morning, made up of 3 measures of pollard and 1 measure of bran. This is mixed to a crumbly state with liver soup. As much is given as the birds will clean up in half an hour. After feeding, the pens are inspected, and if some birds require more it is given to them. At noon a small quantity of boiled liver is given to each bird. Green food is also given, and on hot days extra green food is fed. At night a grain mixture made up of 3 measures of wheat and 1 of cracked maize is fed, and a 2-oz.-tobacco-tinful is given to each bird. Oyster-shell and metal grit are always before the birds.

At another large test a mash is fed in the morning, made up of 3½ measures of pollard, 1 of bran, 1 of chaffed green food, and ½ measure of ground oats, the whole moistened with skim-milk, and as much given as the birds will clean up. From the beginning of April about 5 per cent. of meat-meal is added, and is gradually increased up to 7½ per cent. About August this is gradually reduced, and from September until December only skim-milk is used as animal food, then meat-meal is again gradually added.

At noon chaffed green food is fed, and in the evening grain, consisting of 4 parts of wheat and 1 of oats. Oyster-shell grit and clean water are always before the birds.

### Feeding-systems.

It may be said that there are two main systems of feeding, known as the moist- and the dry-mash systems.

The most popular system is to feed a moist mash in the morning and grain at night. However, as previously stated, experience has shown that it makes little or no difference whether the mash is fed in the morning or in the evening. It is really a matter of which is the most convenient for the poultry-keeper.

The other system is to feed a mixture of meals in a dry state, and place the mixture in hoppers so that the birds can please themselves. The chief advantage of the dry-mash system is that it reduces labour, and is especially

suitable for the poultry-keeper who has to leave for work early in the morning, and who has not the time to prepare a moist mash. It is a system that could be used to advantage on a general farm where the farmer and his wife are usually so busy first thing in the morning that often the fowls do not get fed until after the children go off to school.

Experience would indicate that better egg-returns are usually obtained when both moist and dry mashes are fed.

Some poultry-keepers claim that the dry mash encourages rats and is a more expensive system, and for these reasons, after a lengthy trial, they have gone back to the moist-mash method, while others still like the dry-mash method. Success depends largely upon attention to detail. When feeding dry mash it is advisable to see that ample feeding-space is provided for all birds at the hoppers, and also that more or less equal amounts of dry mash and grain are consumed. If too much mash and not sufficient grain is eaten, it is a good plan to close up the dry-mash hoppers for a couple of hours each day before feeding the grain.

### The Art of Feeding.

The art of feeding is largely a question of common-sense and judgment. A few minutes devoted to watching the birds at feeding-time is time well spent It is not advisable to rush through the pens, as some birds are highly-strung, nervy, and easily upset ; in fact, as a rule the finer-bred a flock is the more highly-strung the birds are likely to be, and it is a great advantage to ensure that your birds have confidence in you.

Again, it is a good rule to feed according to appetite, and, as birds' appetites vary at times according to the weather, and especially when they are laying heavily or taking a rest, a little study of the birds while feeding will enable the beginner to feed more correctly.

Another point to remember is that it is really a waste to feed good expensive food and then compel birds to roost for long nights in damp, poorly-ventilated, or overcrowded houses. Healthy environment during hours of rest is a very important matter, for it is at that time that vitality is at a low ebb.

### Regularity in Feeding.

Irregular feeding means irregular returns. Fowls are creatures of habit, and contentment is a big factor in good digestion, so care should be taken to see that feeding is carried out at regular times. If birds have to hang around the gate waiting to be fed, they get discontented and lose confidence in their owner. Where the poultry-keeper is unable owing to the nature of his work to feed at regular times, he would be wise to try the hopper method of feeding, but if he is irregular through being naturally unpunctual he would be well advised not to take up poultry-keeping as a means of a livelihood, because punctuality is one of the essentials to successful poultry-keeping.

A very important item is water. Nothing will check egg-production quicker than an irregular water-supply, and this is not difficult to account for when it is remembered that one dozen new-laid eggs contain just on one pound of water, and science tells us that 50 per cent. of a bird's live-weight, together with the food she eats, is made up of water. An experiment carried out at the Wallaceville Poultry Station showed that forty White Leghorn pullets when only a few were laying, consumed 3 quarts of water a day, but when they were all laying they consumed 6 quarts 3 ounces of water in a day. These points go to show how very essential a good, constant water-supply is for regular egg-production.

### Exercise Important.

Vigour is likely to deteriorate if birds do not get sufficient physical exercise. The functions of the various organs are kept in good working-order by encouraging, or may it be said, forcing the fowls to take plenty

of exercise. The best way to do this, especially when they are kept on the intensive system, is to feed all grain in deep litter. Judgment is required to see that the litter is in good supply and dry. If the sheds are at all overcrowded or poorly ventilated, it is almost impossible to keep the litter dry. The floor of the house should be at least a few inches higher than the surrounding ground, and between 4 and 5 square feet floor-space should be allowed each bird.

The objective should be to encourage the layers to eat as much as possible, so the mash should be palatable, and all feed-troughs, &c., kept clean and sweet.

If a change has to be made, it should be made gradually.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

# THE APIARY.

### Returning Swarms to Parent Hives.

SWARMS in January are of little value except as increase for the next season, and should be returned to the hives whence they originated if these can be traced. It is a good plan to kill the old queen in the swarm when returning it, at the same time destroying all but two queen-cells in the parent colony. If the hive is cramped an extra super may be given, and with this inducement the colony will usually settle down at once to work.

After-swarms should always be returned to the parent hive. They are easily disposed of even if the beekeeper does not know whence they came. If they are shaken through an excluder into an empty super the virgin queen or queens can easily be picked out as they attempt to force their way through, and once these are removed the bees will return to their old home. The young queens can then be used to replace poor queens in the apiary. It is an excellent plan to have one or two queen-cages always on hand. The young queens can each be confined in a separate cage, and when the queen to be destroyed is removed the closed cage containing the virgin can be placed on top of the frames and left there for twenty-four hours, during which time she will be fed by the bees in the hive. At the end of twenty-four hours she can be released and allowed to run down into the frames, when she will be accepted by the bees.

### Ventilation.

The matter of ventilating the hives should by now be receiving every attention. Every means should be used to ensure the bees having an abundance of fresh air day and night. All weeds and other obstructions should be removed from the fronts of the hives, and the entrances enlarged as much as possible. In extreme cases the hive-bodies should be raised from the bottom-boards by means of small blocks of wood. On no account should the bees be allowed to cluster outside the hives, and wherever they show a tendency to excessive fanning steps should be at once taken to increase the supply of fresh air to the colonies.

### Efficient use of Supers.

One of the necessities of a well-regulated apiary is an abundance of supers when the honey-flow is in full swing. Every inducement should be given the bees during the often brief season to gather in every available drop of nectar. No beekeeper with business acumen will allow his bees to loaf or cluster outside the hives for lack of storage room. It is well when adding extra supers to place them between the brood-chamber and the first super, or at least to raise a few frames of honey from the first super into the second when adding the latter.

It should be understood, however, that supering must not be overdone and the bees disheartened by being given too much work at one time. On no account add a second super until the bees are well at work in the first, and in cases where the colonies are only building up well at the beginning of the honey-flow—that is, where a poor colony has been requeened and the new queen's brood has not as yet hatched—it is an excellent plan to tier up with half-stories. Many an apiarist has had a moderate return from a small colony with half-stories, when it is doubtful if any return at all would have been obtained by the use of full-depth supers.

### Queen-excluders.

January is the month when queen-excluders are of most use, especially in southern districts. Whatever their disadvantage may be in some localities, in the south they have proved their efficacy in enabling extracting to be finished before the hot weather goes, without the destruction of any brood whatever. Excluders should never be used for general purposes until the main honey-flow is in full swing. By that time the bees are used to working in the supers, and, with nectar in abundance to be had all around them, they will work cheerfully right through the hive, passing through the holes in the excluders as if no obstruction existed.

The best method of using the excluders is as follows: All sealed brood should be raised above the excluder, and the queens confined below on drawn-out combs. The brood above the excluder should be watched for a few days in case any eggs have been elevated, as the bees will sometimes attempt to raise queen-cells above the excluder If this happens the queen-cells should be destroyed, as the queens which would emerge from them would not be able to pass through the excluders to get mated, and would in time develop into drone-layers. By providing the queen with plenty of empty combs she will be able to cultivate laying at a sufficient rate to keep up a supply of workers, and as the brood hatches out in the upper stories the cells will be at once filled up with honey.

Excluders are often condemned as being productive of over-swarming, but in many localities swarming ceases automatically as soon as the main honey-flow commences, and if the queen is allowed plenty of room in the brood-chamber, and the brood in the supers carefully watched for the production of queen-cells, very little harm can come from the use of excluders, while the immense advantage of being able to extract combs entirely free of brood is worth a great deal to the apiarist at his busiest season.

### Foul-brood and its Treatment.

Foul-brood, unfortunately, is all too common in some localities, and in consequence beekeepers may at any time have a visitation No one, however, should look upon foul-brood as a necessary evil: it can be cured. It is unknown in some parts of New Zealand, some apiarists who have been keeping bees for ten years or more never having seen it. Other districts that have in the past been troubled with the disease are now free from any sign of infection.

There is therefore no excuse for the presence of foul-brood in apiaries situated in open country: its presence is explained by carelessness on the part of the beekeeper. There is no remedy for American foul-brood superior to the McEvoy treatment, which has been frequently described in the *Journal*, and is more fully dealt with in the Department's Bulletin No. 119, "American Foul-brood in Bees, and its Treatment," which can be obtained free on application. Carelessness in dealing with foul-brood must result in heavy losses, and eventually in the destruction of the whole apiary. Make a point of treating any colonies found to be infected; though there may be only a few cells of disease showing, the infection is there, and it is

not safe to trust to any methods less than the full McEvoy treatment. On no account put supers on infected colonies ; this will only increase the quantity of material that must eventually be destroyed to ensure the eradication of the disease.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

# HORTICULTURE.

## Vegetable Crops.

THE climatic advantages of warm districts for growing these crops are generally recognized, and in the production of early crops they are sometimes very considerable. For many of the main crops and winter crops, however, they are often at a distinct disadvantage. Some of these thrive best in a cool district, and under such conditions insect pests are not so prevalent. In such localities certified seed potatoes may often be grown : swedes and late peas are superior, as also are choice savoy cabbage, cauliflowers, and broccoli. Good brussels sprouts can be grown only in the cooler districts. Selected areas on farms are sometimes leased for this class of cropping, and after three years are handed back, sown down in grass and grazed for a similar period before cropping again. The demonstration has been very instructive to those engaged in mixed farming, and such farmers are taking advantage of the excellent prospects thus opened up. The rest afforded by this class of rotation gets rid of many of the pests and diseases affecting these crops, and intensive grazing is probably the best way of building up fertility again under modern conditions. Combined with the liberal use of fertilizers, this method is probably the most economical way of producing crops of the standard hardy vegetables. In fact, in the warmer districts where early crops are grown and followed up by half-hardy summer crops, a rotation along these lines is best, when supplies of stable or farm manure are not available for maintaining the necessary supply of humus in the soil. The alternative in such a case is to sow down the greater part of the area in oats and horse-beans, &c., in the autumn and grow a heavy green crop for turning under. For this class of cropping fairly light land is required, and the maintenance of a sufficient supply of humus in the soil is the crucial problem under present conditions.

Planting winter crops of celery, leeks, savoys, and red cabbage, cauliflower, broccoli, brussels sprouts, and kale should now be completed. Clean strong plants set out in land that is well prepared can generally be relied upon to give a good crop. Weak, blind plants should be avoided ; and a sharp look-out for any sign of club-root should be kept when dealing with those of the cabbage family. Aphides, and caterpillar larvæ of the diamond-back moth, and white butterfly are persistent enemies of plants of that class at the present time. The attack is less severe as soon as autumn rains and temperatures are experienced. Nicotine sulphate and arsenate of lead have been used with some success for protecting crops from these attacks. If, when the plants are lifted, the tops are dipped in this mixture and allowed to dry off before planting, it will destroy these pests ; but for further protection something less volatile than nicotine and less poisonous than arsenate of lead should be used. We now have an excellent remedy in derris. If a good brand of dust is used after planting out at intervals as required, these pests will do little damage. A dust-gun of modern design costs but a few shillings, and with it the dust may be applied economically, efficiently, and with little labour. As a protection from the attack of leaf-spot fungus on celery-plants, a thorough application of Burgundy mixture should be applied just before lifting and planting out.

On light land in cold districts "early" potatoes are sometimes planted late and left in the ground during the winter and lifted as required. In warmer districts, however, where they are now maturing, they should be lifted as soon as they commence to ripen and before the plants die down. Except in the driest districts, crops of late potatoes should now be sprayed with summer strength Bordeaux to protect them from the attack of late blight, and the application repeated at intervals of three or four weeks or as long as may be necessary.

Crops of autumn-sown onions, shallots, and garlic ripen during the month of January. They should then be lifted and thoroughly cured. If the weather is unsettled this is best done under cover; but in any case they should be given good dry storage for a few weeks to thoroughly harden off the bulbs before cleaning and grading.

The leading growth of such crops as pumpkins, marrows, &c., should now be stopped by removing the tips of the leaders with a view to encouraging fruitful lateral growth. Careful attention will be required in supplying water to the celery crop. It is sometimes overdone: much depends on the subsoil and drainage; also the nature of the topsoil and the fertilizers and manures used. Anything like a water-logged condition should be carefully avoided. Spent crops must be cleared promptly. Delay affords a risk of perpetuating disease and exhausts the soil unnecessarily.

Tomato crops under glass will require attention in feeding, watering, and ventilation to fill out the top fruit. Where seeds are being sown for a winter crop to follow on, arrangements should be made for thoroughly disinfecting the house before planting the new crop. The establishment of the tomato-mite pest, *Phyllocoptes* sp., in the Auckland District (fully described in the July number of the *Journal* by Cottier and Taylor), appears to have been often largely due to neglecting to clear the old crop promptly as soon as the fruit was gathered and thoroughly cleansing the house. For the control of these mites on the growing crop, also aphides and white-fly, fumigation with nicotine sulphate 1 fluid ounce to each thousand cubic feet of house should be used during a calm evening more frequently Where houses are insufficiently gas-tight for fumigation in this way, spraying with nicotine sulphate may be adopted, mixing one pint in 100 gallons of water in which 3 lb or 4 lb. of soap have been dissolved.

The outside tomato crop in most instances commences to ripen towards the end of January, and when the soil is in nice condition after rain a side dressing of fertilizers will often be of assistance to the plants Study the crop well and apply a mixture which will best adjust any undesirable bias which may be present as well as stimulate the plants to enable them to mature the crop well. Clean picking is important, as with any other fruit crop—that is to say, all mature fruit should be gathered at one picking; any overlooked are wasted and encourage attack from birds, or, if gathered later, often lead to a pack of mixed maturity being made, which is unsatisfactory to the buyer.

Sowings of peas and dwarf beans are now sometimes made, but it requires a warm climate to finish them well. Shorthorn carrots and globe beet, silver beet, spinach, and salads may be sown. In the cooler districts spring cabbage is sown towards the end of January, but the following month is otherwise soon enough.

### Small and Sundry Fruits.

The crops of hardy small fruits are now being harvested. As soon as they are finished plantations of black currants, raspberries, and loganberries, which carried the crop on the young wood, should then have that

wood cut out, including weak growths, carefully gathered up, carried out, and burnt. Cut well back to the surface of the ground, or, in the case of currants, to just beyond a bud well down on the branch. The new growth of loganberries running over the surface of the ground is usually best left there until growth commences in the spring, when it may be trained in on the trellis and the ground cleared for the growth of another season. Strawberry-beds which are exhausted should be grubbed out and burnt without delay, and the land prepared for another crop. Where the beds are to be carried on for another season they are cleared of runners, mulch, and weeds ; given a dressing of such manures as they require, and light cultivation to build up constitution for the next crop.

The new canes of raspberries and loganberries are now liable to be attacked by the caterpillar larvæ of a native moth known as *Carposina adreptella*, which eats out the buds. They should therefore be protected by applications of arsenate of lead until the month of March, when egg-laying probably ceases. Without this protection the attack often causes serious damage. The article in the October number of the *Journal* by Muggeridge and Cottier, on the black-currant-bud eelworm should be carefully studied and the suggestions under the heading of " general hygienic measures " of control put into practice. The plants should be closely examined in dry weather, and all infected material cut out and burnt. Where infected bushes are found the ammonia-solution spray should be given a trial experimentally. It is made of ordinary ammonia 3 parts to 100 parts of water. When cuttings are made later it is, of course, important to see that all propagating-material is definitely free from this pest, and is kept from any contact with plants or land which may be infected.

Where land has to be prepared for autumn or winter planting of small-fruit, it should now be fallowed to thoroughly clean up all bad weeds, and it is advisable to work in such manures and fertilizers as may be necessary to put it in good heart. In the warmer districts strawberry-plants are set out so late as the month of April, but in most districts they are best planted as soon as the young plants are available, so that they may become established before the cold weather. Where plants of these or other kinds have to be purchased, the stocks should be carefully examined now and suitable material ordered for delivery as soon as it is ready for removal. Plants should be sturdy, but not over-sized and soft, well-rooted, clean, and true to name. The temptation to purchase cheap material should be dealt with cautiously. Unless the plants are sound and the ground thoroughly clean, planting should be deferred to another season. Most of these crops thrive best in the cooler districts, with a good rainfall, unless irrigation can be done.

### The Homestead Garden.

The pleasure in a garden is often discounted by the heavy demand or cost of labour in maintenance, and to avoid this difficulty care should be taken now when designing new gardens or alterations to old ones. Maintenance is greatly facilitated if the design is simple in outline and the lawn is not overcrowded with isolated specimens of trees, shrubs, and flower-beds. A little planting on a lawn is often desirable to avoid monotony and give variety. The outstanding position is suitable for displaying a handsome tree which will also afford shade or shelter, or for a bed of flowering plants that is given special attention ; but great restraint is necessary both to obtain the best effect as well as to make maintenance easy. Where a mistake of this kind has been made in an established garden, beds may be levelled and turfed down during the autumn, superfluous trees and shrubs removed,

and the site consolidated and turfed over. When of moderate size and lifted with care, shrubs may be replanted in a group on the lawn or elsewhere quite successfully. Banks or terraces of any size or if at all steep may be planted closely with shrubs and possibly trees ; or a dry stone wall may be built, thus dispensing with the grassed face altogether.

Where small paddocks in the vicinity of the homestead may be broken up in rotation for cropping with roots and vegetables by means of horse-drawn implements, the ordinary kitchen garden can be dispensed with, merely retaining an enclosed area for small-fruits and such perennial crops as asparagas, rhubarb, and herbs, also salad crops—an area which will require comparatively little labour, and that of the lightest kind, to maintain it in good condition. With a cool dark shed, well ventilated, and a concrete floor to enable it to be kept clean, potatoes, roots, hard fruits, such as apples, &c., may be kept in good condition for a maximum period with a minimum of loss. Such produce as pumpkins and onions will require the drier position. In these and other ways great economies in labour and produce may be made on many farms.

Not the least important feature in the homestead garden is the lawns ; a thick sward, clean, fine, and of good colour is a necessary setting for the best results. Where the land is moist, well drained, and of good quality, there is little trouble in obtaining a high standard in this respect. Otherwise more attention is required ; but it is an interesting problem for one who has much to do with the management of pastures. The treatment of lawns then takes on something in the nature of experimental plots from which much may be learned regarding local reactions, some of which may have an application to the bigger problems on the farm. The main difference between lawns and pastures is that the former are not grazed, and therefore do not receive the manurial dressings the pastures get. Unless the conditions are of the best, the soil fertility soon shows signs of depreciation and the turf becomes open and weedy, especially where close cutting and hard wear takes place. It is then necessary, as with other crops, to practise feeding to maintain a high standard of growth. This usually takes the form of small periodical dressings of fertilizers, and, in the case of light land, an occasional dressing of a compost rich in humus. Where attention of this kind may be necessary, and in the absence of a good local practice to the contrary, the following mixture may be applied towards the end of January at a rate of 1 oz. per square yard, which is equal to about 300 lb. per acre : 3 parts superphosphate and 4 parts nitrate of soda. The materials should be well mixed, and if a quantity of dry light-screened loam is included it will often facilitate an even distribution being made. It should be applied after rain when the grass is dry.

Where black wattle and eucalypts are grown for shelter and firewood, cutting demands careful consideration. It has been stated that black wattle cut in summer will renew itself very effectively. Eucalypts also will make good second growth, which is useful for shelter and other purposes, if they are properly cut at the right season : this has been stated to be the late winter for preference. It is possible these reactions may vary in different localities, and these treatments require a trial under various local conditions. In most instances it is probable that late in the months of January and July would generally be most suitable for cutting these trees, and they should be sawn off about level with the ground so that new growths will get support and will not readily be blown out.

—*Wm. C. Hyde, Horticulturist, Wellington.*

# ESTIMATED AREAS UNDER WHEAT, OATS, BARLEY, AND POTATOES (SEASON 1937-38).

As in previous years, cards were sent out by post to grain-growers and to potato-growers throughout the Dominion asking them to state what areas they had sown or planted, or intended to sow or plant, in wheat, oats, barley, and potatoes this season. It may be well to note that only holdings of 1 acre and over outside borough boundaries are covered by the figures appearing below. In the case of potatoes a fair amount is undoubtedly grown on the smaller holdings and on holdings situated within boroughs.

WHEAT, OATS, AND BARLEY.—FINAL AREAS, 1936–37, AND AREAS ESTIMATED AS SOWN OR TO BE SOWN IN 1937-38.

| — | Wheat. | Oats. | Barley. |
|---|---|---|---|
| | Acres. | Acres. | Acres. |
| Areas, 1936–37 :— | | | |
| For threshing .. .. .. .. | 221,790 | 74,772 | 20,544 |
| For chaffing .. .. .. .. | 1,400 | 187,694 | 694 |
| Total harvested .. .. .. | 223,190 | 262,466 | 21,238 |
| Not harvested (fed off, &c.) .. | 1,447 | 53,238 | 4,274 |
| Grand totals .. .. | 224,637 | 315,704 | 25,512 |
| Areas, 1937–38 (estimated) :— | | | |
| North Island .. .. . .. | 3,300 | 16,500 | 3,200 |
| South Island .. .. . .. | 184,700 | 269,100 | 27,300 |
| Totals .. .. .. | 188,000 | 285,600 | 30,500 |

Particulars as to varieties of wheat and oats sown or intended to be sown were asked for. The following table gives a summary of results in cases where varieties were specified :—

| — | Wheat. | | | | Oats. | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Tuscan or Long-berry. | Hunters (Varieties). | Velvet or Pearl. | Total Specified Varieties. | White. | Dun. | Black. | Algerian | Total Specified Varieties. |
| | Acres. | Acres. | Acres. | Acres. | Acres. | Acres. | Acres. | Acres. | Acres. |
| North Island .. .. | 930 | 599 | 528 | 2,057 | 902 | 62 | 86 | 5,476 | 6,526 |
| Nelson, Marlborough, and Westland | 2,469 | 1,371 | 437 | 4,277 | 294 | 273 | 123 | 6,939 | 7,629 |
| Canterbury . .. | 102,566 | 23,978 | 3,366 | 129,910 | 50,185 | 12,277 | 4,801 | 44,420 | 111,683 |
| Otago and Southland .. | 9,633 | 5,429 | 653 | 15,715 | 52,664 | 3,166 | 2,838 | 5,322 | 63,990 |
| Dominion totals .. | 115,598 | 31,377 | 4,984 | 151,959 | 104,045 | 15,778 | 7,848 | 62,157 | 189,828 |

Tabulation of statistics for potatoes gives the following results :—

POTATOES.—FINAL AREA, 1936–37, AND AREA ESTIMATED AS PLANTED OR TO BE PLANTED, 1937–38.

| | Final Area, 1936–37. | Estimated Area, 1937-38. |
|---|---|---|
| | Acres. | Acres. |
| North Island .. .. | 5,812 | 4,900 |
| South Island .. .. | 16,650 | 16,800 |
| Totals for Dominion .. | 22,462 | 21,700 |

—*Government Statistician.*

# WEATHER RECORDS: NOVEMBER, 1937.

Dominion Meteorological Office.

NOTES FOR NOVEMBER.

IN most districts November proved a favourable spring month, although the first half was extremely dry and, following a lengthy spell of equally dry conditions, during this period there was a shortage of feed in many parts of the country, and the general outlook for the farming community appeared to be very serious. Between the 15th and 25th, however, beneficial rains occurred at times over the greater portion of the Dominion, and pastures and vegetation revived. In parts of South Canterbury, Otago, and Marlborough, however, the rainfall was not sufficient to relieve the situation, and in these areas food for stock is still short and many crops have been seriously affected. The North Island, on the other hand, with the exception of the Manawatu district, experienced favourable conditions, with the result that feed is now plentiful. On the whole, stock are in good condition and the season has been excellent for the fattening of lambs.

*Rainfall.*—Over most of the northern half of the North Island the month's aggregate rainfall was above the average, the greatest departure being in North Auckland. The whole of the remainder of the Dominion experienced a deficit, places in the eastern and southern areas of the South Island having less than half the November average

*Temperatures.*—Temperatures were everywhere above normal, the departure averaging 2° F. in both Islands. Some days were very warm, but, on the other hand, there were several nights when frosts were severe enough to cause damage to fruit trees and vegetables, more especially at inland places in the South Island.

*Sunshine.*—The amount of bright sunshine recorded nearly everywhere exceeded the average, the only reporting stations having a deficiency being Nelson and Waimate. Blenheim had 259·7 and Napier 251·8 hours.

*Pressure Systems.*—During the first week the weather was fine, almost generally under the influence of a rather intense anticyclone, the centre of which moved to the east of the North Island on the 8th. By the 9th a shallow depression had advanced on to the Dominion and fairly general, though mostly light, rains occurred during the night. Rain also fell over most of the North Island between the 11th and 14th associated with a cyclonic depression which crossed northern New Zealand on the latter day. Up to this time rainfall had not been widespread, and the South Island especially had continued to experience dry conditions.

By the 16th, however, an extensive westerly depression had moved on to New Zealand and general beneficial rains accompanied it about this time. A series of similar depressions continued to cross the Dominion until the 19th, and strong and squally winds between north-west and south-west prevailed, with changeable conditions and rain at times in most parts of the country. Thunderstorms were also frequent during this period, particularly severe ones occurring on the 17th in the Waikato district, and on the 19th in parts of Taranaki and Wellington provinces.

The final storm system of the month was a combination of a cyclone in the north and a westerly depression in the south, both of which crossed the Dominion during the night of the 24th. This disturbance deepened considerably in passing to the east, and consequently, during the night of the 24th and on the 25th, strong southerly winds to gales prevailed, accompanied by heavy showers and, in places, thunder and hail. Particularly heavy rains occurred in the Auckland province, and a severe thunderstorm was experienced in parts of the Gisborne district. This was the only really cold snap during the month, and, fortunately, it was of brief duration. On the 26th anticyclonic conditions with fine weather set in and continued to the close of the month.

RAINFALLS FOR NOVEMBER, 1937.

| Station. | Total Fall. | Wet Days. | Maximum Fall. | Average November Fall. | Total Fall to date. | Average Fall to date. |
|---|---|---|---|---|---|---|
| *North Island.* | | | | | | |
| | Inches. | | Inches. | Inches. | Inches. | Inches. |
| Kaitaia .. .. | 4·39 | 11 | 1·40 | 2·75 | 55·11 | 51·68 |
| Russell .. .. | 5·51 | 8 | 1·94 | 3·19 | 91·98 | 54·86 |
| Whangarei .. .. | 4·68 | 12 | 1·04 | 2·81 | 79·01 | 57·52 |
| Auckland .. .. | 3·18 | 10 | 1·20 | 3·59 | 41·29 | 46·17 |
| Hamilton .. .. | 3·00 | 11 | 1·74 | 4·01 | 35·92 | 46·04 |
| Rotorua .. .. | 4·41 | 11 | 1·42 | 4·18 | 45·12 | 51·25 |
| Kawhia .. .. | .. | .. | .. | 4·52 | .. | 50·42 |
| New Plymouth .. | 2·90 | 14 | 1·13 | 4·70 | 50·96 | 55·49 |
| Riversdale, Inglewood .. | 6·15 | 17 | 1·71 | 9·12 | 80·83 | 96·69 |
| Whangamomona .. | .. | .. | .. | 7·39 | .. | 71·92 |
| Hawera .. .. | 2·85 | 10 | 0·74 | 3·78 | 36·15 | 41·96 |
| Tairua .. .. | 4·21 | 8 | 1·45 | 3·63 | 60·86 | 60·07 |
| Tauranga .. .. | 3·79 | 10 | 1·53 | 3·29 | 50·98 | 48·81 |
| Maraehako Station, Opotiki | 4·17 | 10 | 1·49 | 3·16 | 55·99 | 50·45 |
| Gisborne .. .. | 2·52 | 9 | 1·01 | 2·88 | 37·69 | 42·83 |
| Taupo .. .. | 2·67 | 10 | 1·56 | 3·32 | 29·87 | 40·75 |
| Napier .. .. | 1·26 | 7 | 0·68 | 2·02 | 23·44 | 28·14 |
| Hastings .. .. | 1·00 | 7 | 0·68 | 1·82 | 19·67 | 29·98 |
| Taihape .. .. | .. | .. | .. | 3·40 | .. | 33·46 |
| Masterton .. .. | 1·66 | 11 | 0·59 | 2·69 | 29·65 | 35·47 |
| Patea .. .. | 3·64 | 10 | 0·96 | 4·01 | 38·14 | 41·29 |
| Wanganui .. .. | 1·97 | 8 | 0·93 | 3·24 | 27·56 | 33·42 |
| Foxton .. .. | 1·66 | 9 | 0·50 | 3·20 | 20·61 | 29·87 |
| Wellington .. .. | 2·90 | 9 | 1·31 | 2·99 | 30·97 | 39·37 |
| *South Island.* | | | | | | |
| Westport .. .. | 7·11 | 10 | 2·05 | 8·85 | 71·36 | 88·35 |
| Greymouth .. .. | 8·48 | 17 | 2·22 | 9·10 | 85·79 | 92·90 |
| Hokitika .. .. | 9·11 | 15 | .. | 10·45 | 92·56 | 104·57 |
| Ross .. .. | 8·91 | 14 | 2·89 | 13·86 | 113·02 | 123·44 |
| Arthur's Pass .. | .. | .. | .. | 16·11 | .. | 147·80 |
| Okuru, South Westland | 8·78 | 7 | 2·60 | 12·60 | 125·25 | 133·50 |
| Collingwood .. .. | 4·73 | 8 | 2·29 | 6·90 | 68·48 | 89·19 |
| Nelson .. .. | 2·65 | 7 | 0·99 | 2·92 | 28·15 | 34·86 |
| Spring Creek, Blenheim | 1·85 | 6 | 0·80 | 23·9 | 22·26 | 28·18 |
| Seddon .. .. | 1·14 | 5 | 0·56 | 1·85 | 21·41 | 22·84 |
| Hanmer Springs .. | 1·17 | 10 | 0·25 | 3·46 | 29·78 | 41·29 |
| Highfield, Waiau .. | 1·03 | 7 | 0·35 | 2·52 | 20·10 | 30·64 |
| Gore Bay .. .. | 1·96 | 7 | 0·64 | 2·12 | 27·97 | 28·70 |
| Christchurch .. .. | 0·88 | 9 | 0·31 | 1·78 | 19·46 | 22·67 |
| Timaru .. .. | 0·73 | 5 | 0·38 | 1·95 | 17·09 | 20·26 |
| Lambrook Station, Fairlie | 1·09 | 5 | 0·39 | 1·93 | 15·74 | 22·30 |
| Benmore Station, Clearburn | 0·47 | 6 | 0·23 | 2·05 | 20·45 | 22·30 |
| Oamaru .. .. | 0·46 | 5 | 0·29 | 1·92 | 13·68 | 19·76 |
| Queenstown .. .. | 0·33 | 4 | 0·14 | 2·71 | 21·71 | 27·99 |
| Clyde .. .. | 0·58 | 3 | 0·33 | 1·34 | 12·26 | 13·46 |
| Dunedin .. .. | 1·14 | 7 | 0·36 | 3·21 | 34·19 | 33·18 |
| Wendon .. .. | 1·55 | 9 | 0·49 | 2·72 | 35·19 | 27·14 |
| Balclutha .. .. | 1·20 | 6 | 0·43 | 2·48 | 27·86 | 23·06 |
| Invercargill .. .. | 2·61 | 17 | 1·00 | 4·28 | 36·77 | 41·65 |
| Puysegur Point .. | 6·27 | 22 | 1·61 | 8·25 | 76·11 | 78·09 |
| Half-moon Bay .. | 3·04 | 16 | 0·78 | 5·79 | 51·11 | 53·89 |

# The New Zealand Journal of Agriculture.

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And Miscellaneous Matter.

## NOTICES.

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